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THE OBJECTS OF THIS ASSOCIATION ARE:

"To promote increase of knowledge of the application of dyes and chemicals in the Textile Industry.

"To encourage in any practicable ways research work on chemical processes and materials of importance to the Textile Industry.

"To establish for the members channels by which the interchange of professional knowledge among them may be increased."

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AMERICAN
DYESTUFF REPORTER

VOLUME 25 SEPTEMBER 7, 1936 NUMBER 18

Why Direct Dyes Color Cellulose Acetate

The Long Sought Cause of Substantivity— A New and Plausible Explanation

SUMMARY

Substantivity, or the ability of dyes to deposit directly upon cellulose is one of the most fundamental of the phenomena of direct dyeing. A new theory which seems to deserve special attention has its basis in the residual valency of unsaturated atom groups as the cause of substantivity. That is, in all direct dyes and substantive intermediates there are systems or chains consisting of a number of conjugated double bonds whose residual valency together with some affinity for auxochrome groups causes the attraction to cellulose. The probable correctness of this view has been demonstrated from typical direct dyes and intermediates but certain groups have been shown to interfere. The new theory can serve as a working hypothesis for the synthesis of improved dyes.

BY substantivity is meant the property of certain dyes, leuco-dyes, and dye intermediates of being absorbed from solution by cellulose, and retained. The union between the dye and cellulose is generally considered to be adsorption in contrast to the dyeing of animal fibers which can almost certainly be regarded as a result of chemical combination.

The seat in the dye molecule of this property of dyeing direct has long been a subject of speculation and research. Its study should naturally proceed along with the study of the dyeing process and theories because it is one of the most fundamental parts of the whole phenomenon.

It is the purpose of this paper to present a little of the background of the subject and the main points of the new theory. The present writer has tried to indicate to the organic chemist something of the general nature of the theory without going into details and, by reasonably simple statements, to indicate to the more general or less scientific reader the main ideas that seem to explain why direct dyes act in the very convenient manner in which they do.

One of the most common generalizations is that all substantive dyes have the property of forming colloidal solutions, a behavior which is no doubt based on their chemical constitution. Ruggli and Zimmermann have stated that the few apparent exceptions or limiting cases can be explained. For example the highly dispersed Erika B which does not form large colloidal particles has a relatively low affinity according to their standards. Theories have been based on the idea of a range of sizes of colloidal particles in the dye solutions within which a dye must fall in order to be absorbed by cotton or other cellulose. Rose and his co-workers have recently offered evidence for this view and consider the correct particle size essential to direct dyeing.

The point has been raised also that the degree of dispersion or the colloidal character of dyes may depend upon other factors as well as chemical constitution, for example, upon a somewhat difficult solubility. However, insufficient distinction seems to have been made between true solubility and ease of dispersion. Apparent solubility would seem to require more study before being taken too seriously.

SIZE OF MOLECULE

On the average, also, the substantive dyes have a higher molecular weight than the non-substantive. This is a more tangible idea which has been tested. Ruggli and Zimmermann have noted that beta naphthol has its affinity increased upon adding the necessary groups to form Naphthol AS, and increased to a greater extent upon conversion to naphthylamid, of still higher molecular weight. But, they thought that other grounds than mere size of molecule gave a better explanation of the result. They also tried making progressively longer molecules form J acid but upon testing substantivity found that the effect of molecular size alone was not as great as expected. In general terms, dyes of high molecular weight are not necessarily colloidal nor substantive.

Experience with certain dyes has suggested that a bipolar character of the dye molecule is necessary, that is, that the positive and negative electrical effects must be concentrated in different parts of the molecule. As an illustration Diamine Blue 6B (C.I. 314) and Naphthol Black B (C.I. 315) are very similar in structure.

The first is a direct dye while the second leaves cotton white. The first has two sulfonic groups in one end of the molecule while the second has two in each end. The first is a dipole due to the unbalance caused by the two sulfonic groups while the second is not. However, there are dyes which are not bipolar in this sense but which are substantive.

Substantivity has been attributed to the long chain form of the molecule and as a matter of fact all substantive dyes have more or less of this character, even some dyes of natural origin. However, the author showed that neither this nor the other properties mentioned were alone sufficient to impart substantivity because a compound which he prepared to meet these requirements did not dye cellulose directly to any appreciable extent although it should be strongly substantive according to the theory behind its structure.

Meyer, partly as a result of his work with Mark, has offered the idea that direct dyeing takes place when the free partial valencies of the cellulose crystallites are saturated by partial valences of the dyestuff micelles. Meyer attributed the origin of the valence forces to certain atom groups which occur frequently in the dyestuff molecules, such as hydroxyl groups but especially the carbonamid group, CO-NH, but this does not get to the bottom of the matter. There are direct dyes which do not have these groups. A familiar example is Chrysophenine G which has none of either of them. Hence these groups are not necessarily the seat of the substantivity although this theory is probably true in a general way.

Incidentally micelle formation would seem to follow from the attraction for each other of atoms or groups of dissimilar charge, whether they are dye micelles in solution or the micelles in solid cellulose. However it is not universally agreed that there is micelle formation in cellulose and the unit of structure may be the individual cellulose chain instead. At any rate there are still residual affinities that can attract dyes.

There are enough inconsistencies and exceptions to disprove these and various other theories which have been offered heretofore.

THE NEW THEORY

According to Schirm who has proposed the new theory, if the known direct dyes are studied for the possession of some general characteristic it is seen that they all have a multiple system of conjugated double bonds.

Conjugated double bonds are double bonds separated by single bonds as shown.

$$R - CH = CH - CH = CH - R$$

They have peculiar properties due to this grouping but the principal point about them for our purpose is that there is a partial valency at each side of the double bond. In substitution reactions it has appeared that the partial valences on the two middle carbons have neutralized each other and made those at the ends of the chain more active. Substantivity, however is another matter and it does not seem necessary to assume that the dye affinity is located mainly at the ends of the chain of double bonds.

Other atoms than carbon may be linked in the system and it may run to a larger number of double bonds. In longer systems, of three or more double bonds, the partial valences have been regarded as appearing at the ends of the chains, and Schirm seems to accept this idea. However, there do not seem to be any very definite general rules for such a variety of systems as may be found in direct dyes. Hence, where it is merely a case of adsorptive force the attraction or substantivity may concentrate or become distributed along the dye molecule to "fit" the cellulose.

Three or more such bonds may also be present in the form of a branching chain as "crossed double bonds". It also appears that the end partial valences in a long or crossed chain may neutralize each other, but this does not seem to interfere sufficiently in the case of dyes to prevent substantivity. It would seem to distribute the forces along the chain rather than concentrating them at its ends.

These valence forces are also the cause of the colloidal properties in solution.

Their effectiveness for substantivity is a function of the chain length. While eight double bonds seemed, at first, to be the minimum requirement it has appeared upon further study that the number of conjugated double bonds necessary for pronounced affinity for cellulose varies considerably with the particular nature of the conjugated system and the kind of groups which are present to impart solubility. Nitrogen atoms in the system act more strongly than carbon and may compensate for lack of length in the chain of double bonds.

While there is much more to be learned about the details, the theory as a whole sounds very promising. The dye is fixed by the interaction of the partial valences of the dye and fiber. This mutual saturation may be favored by the long chain form of the cellulose units and the elongated shape of the dye molecule.

Preston also has furnished good evidence by optical means, or oriented adsorption of dye by fiber.

APPLICATION OF THE THEORY

We now come to the more specific application of the theory. The classical example of an azo dye component is Benzidine; resulting dyes are usually substantive. The simplest benzidine dye has eight conjugated double bonds between the two color giving groups.

The important intermediate "J" acid has three conjugated double bonds which zig-zag through its structure from the amino group, one less double bond than benzidine. Its substantivity is not as pronounced but it is probably helped by the presence of two auxochrome groups instead of one.

The conjugated system is counted only up to the auxochrome group or up to the auxochrome which is farthest removed from the point of coupling. This is based on the idea that the auxochrome, particularly an amino

group, adds to the partial valences on account of its unsaturated nature.

Gamma acid is another type of case. It has three double bonds "crossed" or arranged in a "Y". Its relatively weak contribution of substantivity is attributed to the lack of length of conjugated system.

Finally there is "H" acid which contributes still less to substantivity. Here two of the three double bonds are crossed and the chain is still shorter, although other structural features may also influence the dyes resulting from its use as an intermediate.

Dyes containing thiazol, oxazol or imidazol rings have the conjugated double bonds, for example a chain of eight in Primuline. These dyes do not introduce anything new in the explanation.

The degree of substantivity of dyes seems to be very readily explained by the same general theory. In certain cases an imino group in the chain in place of one of the double bonds does not interfere.

Although we have been able to demonstrate that the occurrence or non-occurrence, and the various degrees of substantivity of a large number of dyes and intermediates could be very well explained by the new theory, we still have to explain the fact that of two dyes of almost identical structure with the same systems of conjugated double bonds one is substantive and the other not.

An example is the pair of dyes Diamine Blue 6 G and Naphthol Black B, already mentioned which are nearly alike, one outstanding point of difference being the presence of two sulfonic acid groups at *one* end of the molecule of the first and of two such groups at *each* end of the other. Why do the sulfonic acid groups interfere with the direct dyeing of one of these dyes and not with the other? The answer is important because such groups are depended upon to impart solubility.

In checking up certain dyes which are substantive it is found that there are no sulfonic groups on the carbon ring which forms, (with the azo and auxochrome groups) the system of conjugated double bonds. This is not the case with the Naphthol Black B.

This has been found true for a large number of cases. It does not mean that there can be no sulfonic acid group at all on the ring which belongs to the conjugated system of double bonds, but that a certain part of this complex system must be free from interfering groups. The effect is not limited to sulfonic acid but may be brought about by some other groups and certain positions of substitution.

Basic atom groups, like the amino and quaternary ammonium which impart solubility, favor substantivity while acid groups like the sulfonic and carboxyl are unfavorable. This favorable action of basic groups on substantivity is probably due to the weak acid character of the cellulose.

In an exceptional case it has been proposed that certain parts of the dye molecule are not free to rotate into the same plane, which would probably favor the necessary contact with the cellulose. It seems that a uniformly distributed dipole character along as much of the chain length as possible, and acting perpendicular to the long axis is favorable for substantivity.

Other apparent exceptions are explained. Among the explanations it is brought out that increasing the size of the molecule of a substantive dye does not necessarily increase the substantivity. In the so-called naphthols with their relatively short conjugated chain there is substantivity only at lower temperatures. At higher temperatures they dissolve to molecular (rather than colloidal) dispersions.

The true direct dyes with long conjugated systems show the greatest substantivity at 60 to 100° C., below which temperature they are dispersed in too coarse a state to be able to penetrate into the fibers. It may be, then, that if the chains of conjugated double bonds are too long they form too large particles even at the boil and would have to be dyed at a still higher temperature. Perhaps some very large aggregates which should be very strongly substantive but fail to dye cotton to the extent expected act in this way and might be called super-substantive. Also such dyes would seem to be faster, to water at least, than ordinary direct colors.

As to the substantive dyes always being colloidal in solution, we have in contract the non-substantive meta isomer of the substantive Benzopurpurine 4BS. It has but little molecular association in solution, which must be attributed to groups which prevent the colecules coming together into micelles.

AS A WORKING HYPOTHESIS

A theory is of special interest if it can serve as a working hypothesis leading to the preparation of useful materials and Schirm believes that the new substantivity theory will do this.

In the natural substantive dyes the systems of double bonds are mainly aliphatic while in the azo dyes there are few of the aliphatic bonds aside from the azo and (enolized) carbonamid groups. While these natural dyes are lacking in fastness and not suitable for use, aliphatic double bonds might serve as a source of substantivity in the synthesis of other dyes.

Schirm demontrated this point by adding aliphatic double bonds to Metanil Yellow in such a way as to show that either one or two of them added pronounced substantivity to this non-direct-dyeing color. In another case in a worthless dye the substitution of an unsaturated carbonyl compound for a group formerly used converted it to a cotton color. These examples illustrate the point but give only a slight indication of the possibilities for improvements in direct dyes.

Besides the aliphatic double bonds there are heterocyclic ring systems—rings with some other element in addition to carbon, as furan and pyrrol with oxygen and nitrogen—which are less stable and more unsaturated than the benzene ring. Their introduction into dyestuffs should yield products which are more strongly substantive than those with benzene rings.

A somewhat similar theory with a more limited application has also been proposed by Krzikalla and Eistert for the naphthols. In their work attention is called to the fact that the greater affinity of Naphthol AS as compared with beta naphthol has been considered due to the presence of the acid amid group in the former.

Representing Naphthol AS by

$$R—CO.NH—C_6H_5$$

the question was raised whether its homologue

$$R—CH_2—CO.NH\ .C_6H_5$$

with a methylene group between the naphthol and the acid amide would have a similar high degree of substantivity.

Such a "homo-Naphthol AS" was prepared and found to be no more substantive than *beta* naphthol. That is, there was a loss.

It appeared that the methylene group interrupted the chain of conjugated double bonds which extends through the Naphthol AS molecule. The acid amid contributes through desmotropism or the formation of a hydroxyl and shifting of a double bond as shown below:

$$\text{Nap—C(=O)—N(H)—R'} \quad \vdots \quad \text{Nap—C(OH)=N—R'}$$

While the general theory was not developed, to the extent to which it has been carried by Schirm some additional evidence was given.

References

This article is based mainly on the presentation of this new theory by E. Schirm in a paper "Ueber das Wesen der Substantivitaet" in the Journal fuer praktische Chemie *144*, 69 (1935), together with some data from the other references given. No pretense has been made of fully covering the literature on this subject.

Ruggli and Zimmerman, Helv. Chim Acta *14*, 101 (1931) and *14*, 127.

Krzikalla and Eistert. J. prakt Ch. *143*, 50-8 (1935).

Relative Dye Affinities of Cellulose Fibers

QUESTIONS are frequently raised as to the dye affinity of different cellulose fibers. One of the common methods for estimating dye affinity is to dye the materials in question together in the same dyebath and compare the depths of shade. In such a test there is almost nothing fixed or constant and the depth of shade produced might be affected by the rates of dyeing of the different materials as well as by their intrinsic affinities.

Data are needed based on definite test conditions. Hanson, Neale, and Stringfellow have recently furnished a few data on the comparative amounts of dye absorbed under definite conditions such that the figures can be taken to represent relative dye affinities. Their paper does not emphasize this feature of their work as much as some of the other results but does contain these data.

It is essential to describe the materials as well as the dyeing conditions. Ordinary cellulose was represented by carefully bleached fabric of Egyptian cotton. Mercerized cellulose, a badly misused term, was prepared from some of the same fabric allowed to shink in caustic soda with no restraint beyond that imposed by the weave. There was nothing to represent ordinary commercial mercerizing whose affinity or activity would fall below that of the so-called mercerized material described above.

Other types of cellulose represented were cellophane, an ordinary viscose rayon and a cuprammonium product (Bemberg).

The dyeings were made at equilibrium under such conditions that there was practically no change of concentration of dye in the bath during the dyeing. This requires a very large amount of dye in a large bath as compared with the weight of cellulose and the amount of dye absorbed. With this sort of bath for each cellulose, the dyeing is started and completed under just the same conditions in each case and each cellulose can take up all that is possible for it without any effect of decreasing bath concentration.

As will be seen from the following specific example the conditions are far removed from those of ordinary practical dyeing but are much more definite. Direct Sky Blue FF (C. I. 518) was used and in a typical case was dyed for 4 hours at 90°C. at a concentration of 0.05 grams of dye and 5 grams of sodium chloride per liter in a bath of 2500 or more times the weight of cellulose.

The special mercerized cotton was dyed in shades of 0.175 to 2.54 per cent of actual dye on the fiber as compared with the bleached ordinary cotton at 0.1 to 1.57 per cent. The average ratio, which might be called an activity ratio, was 1.6 : 1 through the range of salt concentrations which yielded the ranges of depths of shade already stated. In this case, that is, with these fibers there would seem to be a fairly definite dye affinity which is independent of the amount of salt used in the dyebath.

The other three materials did not show as definite activity ratios, such as we have just translated as dye affinity. The relative dye absorptions varied with the conditions of the dyebaths, that is, with the amount of salt. When the pure unmercerized cotton absorbed at 0.06 per cent the cellophane took up little more than half as much; at one-half per cent for the cotton the ratio was 2.29; and at 1.57 per cent the cellophane took up 2.27 times as

much. Above ½ per cent on the cotton there was a fairly constant ratio at an average of about 2.3 times as much dye on the cellophane.

In other work cellophane has been found similar to ordinary viscose rayon. A few tests on such rayon gave ratios of 1.14 and 2.13 when the cotton had absorbed 0.173 and 0.49 per cent of dye. Viscose would probably display somewhat more than twice the dye affinity of ordinary bleached cotton under these ideal conditions.

Similarly with cuprammonium rayon there was an increasing ratio up to the point where the comparative cotton was dyed to about one-half per cent, when the relative amount of dye absorbed became practically constant at about 2.7 times as much for the rayon.

The indications are that the relative affinities or activity ratios within the limitations of this particular research are as follows when compared with cotton when it dyes ½ to 1½ per cent shades.

Unmercerized bleached cotton	1.0
Special mercerized bleached cotton	1.6
Cellophane	2.3
Viscose rayon	2.1
Bemberg rayon	2.7

It is hardly necessary to explain that these figures are likely not to be just the same for different lots of any given material and the tests were made on only one dye. Ordinary mercerized cotton will probably fall between the first two.

It is apparent that these figures are rather different from the experiences of practical dyers but they are probably nearer to true representations of the relative affinities of these materials for one particular dyestuff than would be obtained in dyehouse experience.

Full credit for all experimental data belongs to the original authors. The results are all theirs but the interpretation has been carried somewhat beyond theirs in one particular direction. The original paper is a very interesting part of their extensive research on The Absorption of Dyestuffs by Cellulose. It is to be found in Transactions of the Faraday Society, Vol. 31, page 1718, of December, 1935.

Rules Designed To Prevent Kier Accidents

Work of British Committee

C. H. S. TUPHOLME

HAPPILY, nothwithstanding the corrosiveness of the liquors employed and the necessarily dangerous nature of many of the processes in the dyeing and allied industries, accidents are comparatively few. Some months ago, however, four boys aged about 15 were working inside a kier and were scalded to death by hot liquor inadvertently admitted by a fellow operative. This disaster was responsible for the setting up of a Government Committee to make recommendations for the safety of operatives working in and about kiers, and recommendations have been made to the British Home Secretary as a result. These recommendations are embodied in a series of draft rules.

These rules are to be known as "The Kier Rules" and are intended to apply to kiers used for the purpose of boiling cloth, yarn, lace, loose cotton, or other textile material, and to accessories, appliances, pipes, channels and ducts, used in conjunction with such kiers.

Provided that in the case of a kier fitted with a mechanical piler, or which is customarily filled from outside without entry into the kier, and where entry is only made for the purpose of sheeting up the material after filling or occasionally for rectifying some fault, Rules 13, 14 and 15 shall not apply.

Where it is proved to the satisfaction of the Chief Inspector of Factories that by reason of exceptional circumstances in any works subject to these rules, or by reason of the infrequency of the process, or for other reasons, all or any of the requirements of the rules are not necessary for the protection of persons employed in such works, he may by certificate in writing (which he may in his discretion revoke) exempt such works from all or any of the provisions of the same, subject to such conditions as he may by such certificate prescribe. Where such an exemption is granted, a legible copy of the certificate showing the conditions subject to which it has been granted, shall be kept affixed in the works.

For the purpose of these rules the following definitions are used:—

Pressure kier means a kier so constructed and arranged that it may be worked at a pressure above atmospheric pressure.

Atmospheric or open kier means a kier so constructed and arranged that it cannot be worked at a pressure above atmospheric pressure.

Kier system means a kier together with its inlet and outlet and circulating pipes, and any pump, injector, steam pipe or heater used in connection with that kier.

Hot liquor or hot water means liquor or water at a temperature exceeding 105° F.

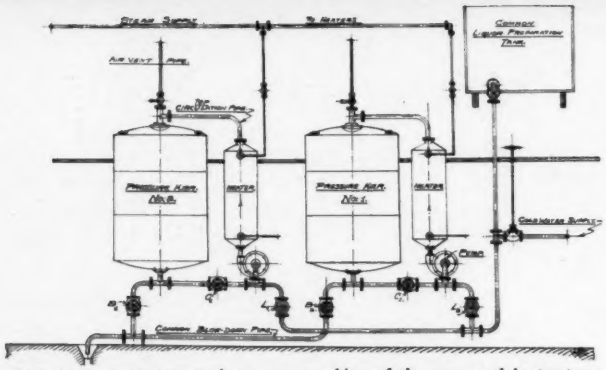

FIG. 1—An arrangement of two pressure kiers of the pump and heater type connected up to their inlet and outlet systems of pipes as commonly met in practice. Reference to the sketch will show how accidents have occurred. (a) Both blow-down valves, B_1 and B_2, are joined to a common blow-down or drain pipe, giving the risk of "backing-up" of liquor from a kier under pressure into one that is empty. (b) A common liquor pipe is provived and should both liquor valves L_1 and L_2 be opened together, the contents of a kier under pressure would be blown into the empty one. (c) If a liquor valve L_1 or L_2 should be open, hot liquor, allowed to enter the system from the liquor tank could pass, via the pump and heater, to the top of the kier; or, a circulating valve C_1 or C_2 being open, hot liquor could enter the bottom of the kier. (d) Any liquor present in a pump or heater could be forced into the top of the kier should the pump be started by any means.

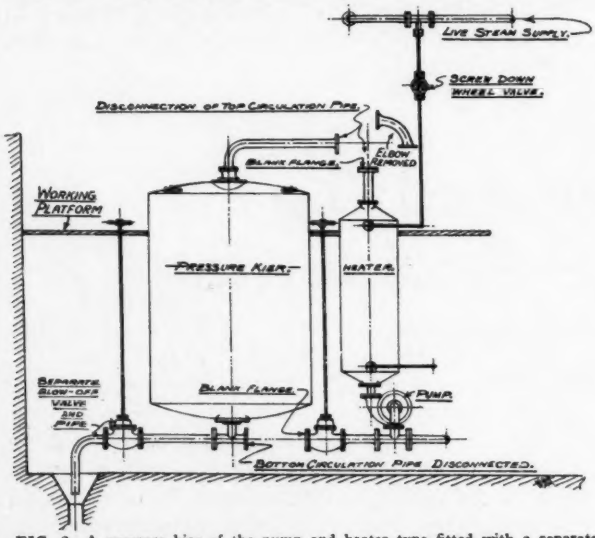

FIG. 2—A pressure kier of the pump and heater type fitted with a separate blow-off valve and drain pipe. The kier is completely isolated from every other kier system by means of the disconnection shown of both the top and bottom circulating pipes. This is the simplest form of connection, but involves the breaking and remaking of two joints in each case, and blanking the supply ends. The same results can be more conveniently obtained by a disconnection appliance.

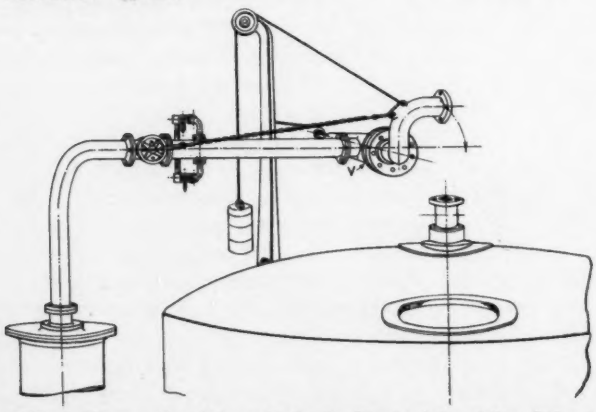

FIG. 3—Disconnecting device made by the Bleachers' Association, Ltd. A combined elbow and swivelling valve is inserted in the top circulating pipe and is shown in the disconnected position. Liquor is automatically prevented from flowing through the pipe by means of a swivelling valve inside the casing V. A counterbalance weight facilitates easy operation.

Competent person means a person who is experienced in the operation and working of kiers, and who is capable of manipulating and working in accordance with these Rules, all valves, taps, pumps, disconnecting arrangements, or other appliances provided for the kiers.

Kier Entry.—For the purpose of these Rules, a person is deemed to have entered a kier if, in the case of a pressure kier, his feet and legs are within the kier, or, in the case of an atmospheric or open kier, his feet and legs are within the circumference of that kier.

Duties.—It is the duty of the occupier to observe Part I of the rules. It shall be the duty of every person employed in or about the kiers to observe Part II of the rules.

PART I

Duties of Occupiers

(1) *Steam Admission.* The admission of steam into a kier or kier system is to be controlled by a screw-down wheel valve, and not by a tap or cock. In every kier which is customarily entered for the purposes mentioned in Rule 19, means are to be provided for locking the valve in the closed position or disconnecting the steam supply.

(2) *Pumps.* Where the circulation of liquor in a kier system is effected by means of a pump, efficient means must be provided for preventing the accidental starting of the pump.

(3) *Means for Ingress and Egress.* Ladders suitable for easy entry into, and egress from, the kiers are to be provided and kept available in a position near the kiers.

(4) *Maintenance.* Every valve or tap controlling the admission of steam, liquor or water to a kier, and the special safety appliances required by these rules, must be kept in good repair.

(5) *Safe Position of Valves and Taps.* The control for any valve or tap must be so placed that the person operating it is not exposed to the risk of scalding.

(6) *Safe Discharges.* The open end of the pipe through which the liquor is discharged from any kier, and the open end of a vent, inlet or other pipe through which liquor may escape from a kier, must be so placed or arranged that no person is exposed to risk of scalding.

(7) *Distinguishing Marks.* Every kier is to have a number or distinguishing mark clearly and legibly marked on it. The control of every valve, tap or disconnecting arrangement used on a kier or kier system must be clearly and legibly marked with the same number or distinguishing mark as the kier; except where the valve tap or disconnecting arrangement is clearly connected with the kier system.

(8) *Bayonet Jointed Kier Covers.* Where a kier has a bayonet jointed cover, efficient means are to be provided for preventing (a) the rise of pressure inside the kier above atmospheric pressure before the cover is in the fully locked position, and (b) the movement of the cover before the pressure inside the kier has been reduced to atmospheric pressure.

(9) *Discharge Pipes.* The pipe used for discharging the liquor from a kier must not be connected with a dis-

charge pipe from any other kier through any common pipe, channel or chamber, in which the pressure can rise above atmospheric pressure.

(10) *Spacing and Height of Atmospheric or Open Kiers Above Platforms.* In crofts erected or substantially reconstructed after the date at which these rules come into operation, atmospheric or open kiers are to be so arranged and fixed that—

(a) The height of the edge of a kier above the working platform or standing place is to be not less than 2 ft. 9 in.;

(b) The space between one kier and the next must be not less than 18 in., and at other points there must be a space for passage not less than 12 in. wide.

(11) *Spacing and Height of Atmospheric or Open Kiers in Existing Crofts.* In crofts which were in use before the date at which these rules came into operation:—

(a) The height of the edge of a kier above the working platform or standing place must be not less than 2 ft. 9 in., or the kier must be securely fenced to that height;

(b) Where the edges of adjacent kiers are less than 9 in. apart, a gangway of not less than 18 in. wide must be provided over the space between the adjacent kiers. This gangway must be of adequate length, and provided with safe means of access. The gangway and means of access to it must be fenced to a height of 2 ft. 9 in., either by upper and lower rails, or by sheet fencing.

(12) *Hot Liquor in Tanks.* (a) Hot liquor is to be prepared in a vessel or tank separate from the kier in which such hot liquor is to be used, and must not be admitted to the kier until the loading has been completed.

(b) Every fixed vessel or tank containing hot liquor or hot water must, if the edge of such vessel or tank is not 3 ft. above the level of the adjoining platform or standing place, be:—

(i) fenced to a height of 3 ft.; or

(ii) provided with an effective grid or other effective cover.

(c) No plank, ladder, stair or gangway is to be placed over any uncovered kier, tank or other fixed vessel containing hot liquor or hot water, unless it is securely fixed and securely fenced to a height of 2 ft. 9 in. on each side.

(13) *Liquor and Water Admission Pipes.* Every supply pipe through which liquor or water is conducted to a kier must be provided with efficient means for preventing the entry of such liquor or water into the kier; such means must consist of arrangements for the complete disconnection of the pipes, in such a way as to isolate the kier from any other kier or vessel, and so constructed that no liquor can flow from the supply side of the disconnected end of the pipe.

Provided that where the pipe for conveying the liquor from the preparation tank to a kier is entirely separate from the supply pipe to any other kier, and the liquor enters at the bottom of the kier, the disconnection of such liquor shall not be required.

Provided also that where water is supplied to one or more kiers from a common main, the provision of a non-return valve in the branch pipe to each kier will be considered sufficient isolation.

(14) *External Circulation Pipes.* Every kier in which the circulation is effected through an external pipe, is to

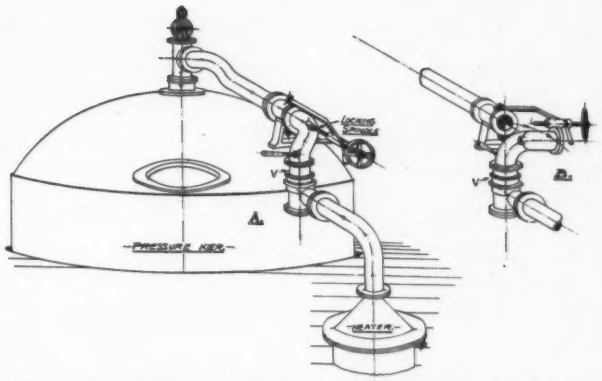

FIG. 4—Disconnecting device submitted by the Bradford Dyers, Ltd. The top circulating pipe is shown at A in the working position and is disconnected by unscrewing the locking spindle, by means of the hand-wheel, allowing the elbow to be swung clear as shown at B. This action disconnects the circulating system and closes the swivelling valve V.

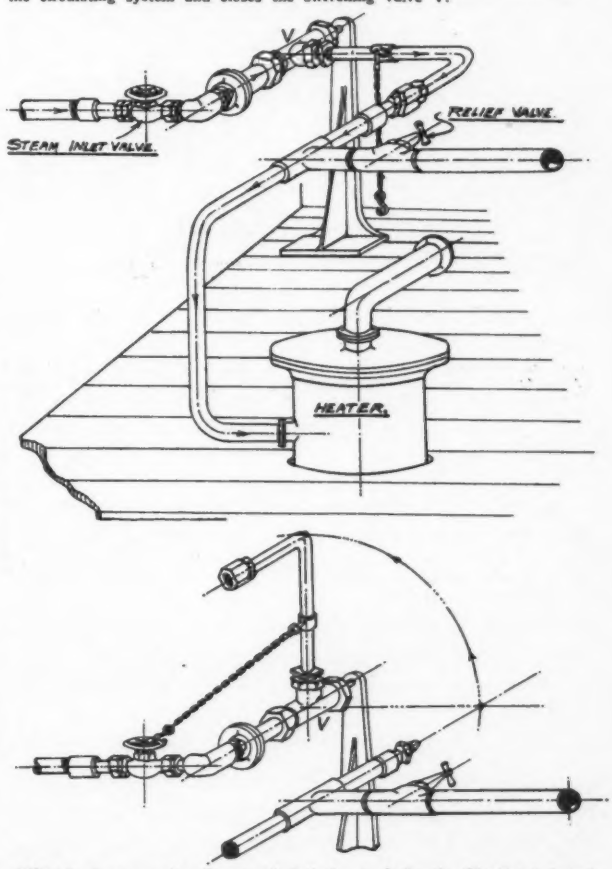

FIG. 5—A steam pipe disconnecting device made by the Bleachers' Association, Ltd. The steam on its way to a heater, or an injector, or directly into a kier, is passed through the swivelling valve V. The top view shows the working position, and in the lower view the disconnecting arm is shown rotated which automatically cuts off the steam supply.

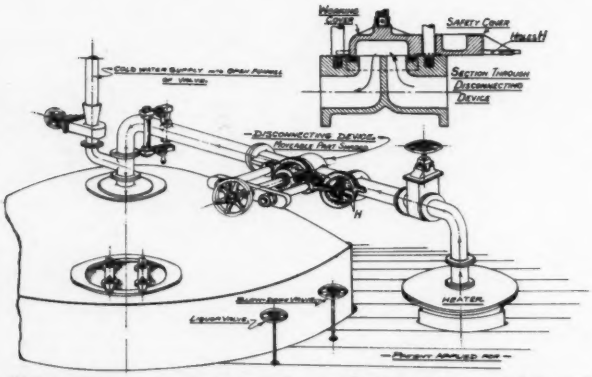

FIG. 6—Disconnecting device made by the Bleachers' Association, Ltd., and fitted in the top circulation pipe of a pressure kier. The device is shown in the working position. When the double flange cover is reversed, all flow is prevented; at the same time, the kier portion of the pipe is opened to atmosphere through holes H in the disconnecting flange.

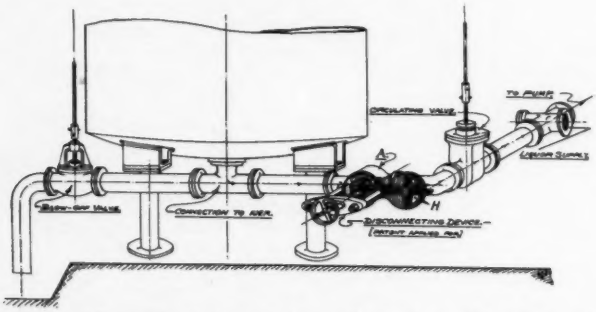

FIG. 7—Disconnecting device made by the Bleachers' Association. Ltd., and shown fitted to the lower liquor supply pipe to a pressure kier. "A" indicates the working position. the safety flange being clearly visible on the right. The two holes, H, in the safety flange open the kier side of the bottom supply pipe to atmosphere when the cover is swung around into the safety position.

be provided with means for completely disconnecting such pipe, so arranged that no liquor can flow into the upper part of the kier or escape from the disconnected end of the pipe.

(15) *Internal Circulation Pipes.* Every kier system in which the circulation is effected through an internal pipe or puffer pipe, must be provided with efficient means for either—

(a) completely disconnecting the steam pipe, or

(b) closing the top of the puffer pipe.

(16) *Responsibility for Kier Operation.* (a) The occupier must appoint a competent person to control the working of each set of kiers in accordance with the rules, and the entry of persons therein. Each such person must be named by notice affixed near the kiers, and be known as the "Authorized Person." Provided that the occupier may name a second authorized person to act as deputy during the absence of the first authorized person, and may also name a particular person to perform certain operations in connection with the completion of operation and blowing down of the kiers.

(b) There must be provided for every kier subject to Rules 13, 14 and 15, a notice or sign indicating when the kier can safely be entered.

PART II

Duties of Persons Employed

(17) *Responsibility of Authorized Persons.* The authorized person is to be responsible for the proper working in accordance with these rules of all valves, taps, disconnecting appliances, pumps, etc., in connection with the kiers, and for controlling the entry of persons into kiers.

(18) *Non-Interference by Unauthorized Persons.* No person other than an authorized person may interfere with, manipulate or work (without the knowledge and consent of the authorized person) any valves, taps or other appliances coming within the scope of these rules. Provided that this shall not preclude any other person, in a case of emergency or likelihood of serious danger or damage, from taking such action as may be necessary in the circumstance of the case to avoid such danger or damage.

(19) *Precautions Before Entry into Kiers.*—(1) The authorized person is to take all reasonable care to ensure that no person shall enter into or remain in a kier for the purpose of plaiting down, filling, arranging, packing or emptying cloth, yarn, lace, loose cotton, or other textile material until he has ascertained that the following precautions are observed:—

(a) The kier has been isolated from every other vessel by the means provided under Rule 13.

(b) In the case of a kier with an external circulating pipe, the disconnection and interrupting of flow as required by Rule 14 has been effected.

(c) In the case of a kier with an internal circulating pipe or puffer pipe, the steam pipe disconnection has been effected, or the top of the puffer pipe has been effectively closed.

(d) No hot liquor or hot water is present in the kier or kier system.

(e) In the case of a kier with pump circulation, the pump has been effectively secured by the means provided by Rule 2 against accidental starting.

(f) Every branch steam pipe by means of which steam may flow into a kier or kier system has either been disconnected or the valve controlling the supply of steam has been closed or locked.

(g) A notice or sign has been affixed close to the entrance to the kier, indicating that the kier may be entered.

Provided that in the case of a kier fitted with a mechanical piler, or where the kier is customarily filled from outside without entry, and where entry is only made for the purpose of sheeting up the materal after filling or occasionally to rectify any fault, the foregoing requirements of this Rule except (d) shall not apply, and instead thereof the following requirements shall apply:—

(2) The authorized person must take all reasonable care to ensure that no person is allowed to enter or remain in a kier unless:—

(a) All valves or taps which control the admission of steam, liquor or hot water into that kier are closed;

(Continued on page 495)

PROCEEDINGS OF THE
American Association of Textile Chemists and Colorists

SEPTEMBER 7, 1936

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Members should notify the **Secretary** immediately of all address changes

Standard Wash Fastness Samples

Cotton, Wool, Silk

The standard samples which have been in preparation for some time by the Sub-Committees on Fastness to Washing of Dyed Cotton and Dyed wool are now ready for distribution, and the original standard silk sample cards have been revised to correspond with the new system of classification first introduced in the 1934 Year Book.

These standards have all been carefully dyed with the dyestuffs and according to the dyeing methods recommended in the 1934 Year Book and each set includes a dyeing representing each of the different classes of fastness.

With these sample dyeings for reference it will be possible to accurately grade the fastness to washing of any dyed cotton, wool, or silk fabrics, by comparing them with the standards after subjection to the standard washing tests as approved by the Association.

The A.A.T.C.C. is now prepared to furnish these three sets of washing standards for $3.00 or $1.00 per individual set which is to cover the cost of preparation.

All inquiries concerning these washing standards should be addressed to the Chairman of the Research Committee.

LOUIS A. OLNEY,
LOWELL TEXTILE INSTITUTE,
LOWELL, MASSACHUSETTS.

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the secretary any vacancies which may occur in their businesses.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE. Prospective employers may file vacancies either with the secretary or the American Dyestuff Reporter.

A-6

Education—Analytical Chemistry and Dyeing Course, Lowell Textile Evening School.

Experience—Seven years as print color and dye chemist in printing, dyeing and finishing plants; recently in charge of textile printing department of dyestuff manufacturer.

A-B-2

Education—Lowell Evening Textile School, 1917.

Experience—Five years' experience in hosiery dyeing, full fashioned hosiery of silk and cotton and silk, also men's hosiery containing rayon, wool, cotton and celanese. Several years experience in laboratory work. Has also had experience in jig-dyeing of cotton piece goods, slub and top dyeing.

A-B-4

Education—B.T.C. 1934, Lowell Textile Institute.

Experience—Assistant chemist in cotton knitting plant; second-hand in woolen knit goods dye house. Will go anywhere; references.

A-B-5

Education—Graduate of the University of Lausanne, Switzerland. Doctor's degree in Chemistry. Knowledge of French and German.

Experience—Eleven years with large bleaching, dyeing, printing and finishing plant as assistant Chemist and then Chemist in charge of the Laboratory. Experience in dyeing and printing cotton and rayon fabrics; research and analytical work. Woman.

A-B-7

Education—Evening school in textile dyeing.

Experience—2 years laboratory in dyehouse; 9 years dyer and foreman on hosiery, ribbons and rayon; 2 years assistant to superintendent. Can handle help efficiently. Desires position as supervisor or demonstrator of dyestuffs. Age 30; married. Prefers vicinity of New York.

A-B-C-2

Education—Graduate of Lewis Institute of Engineering of Chicago and graduate of Philadelphia Textile School (Chemistry and Dyeing department).

Experience—Has had extensive experience as assistant chemist and colorist in silk printing, dyeing and finishing; also dyeing raw stock wool; and dyeing and finishing cotton and rayon. Age 30; married; references.

A-B-C-3

Education—3 years at Brown University and Drexel Institute.

Experience—2½ years in dyestuff laboratory; 3 years as second-hand, dyeing indanthrene and direct colors on rayon skeins; 6 months as boss dyer on silk and cotton ribbons and hosiery; 3 years overseer of dyeing and finishing rayon tubing. Can handle laboratory, dyehouse, finishing or outside service. Age 30; married.

A-B-C-D-E-1

Education—B.S. Chemistry, Mass. Institute of Technology.

Experience—Plant and laboratory work. Knowledge of wool scouring; cotton, worsted, celanese and rayon slashing; bleaching, dyeing, printing and finishing of cotton cloth; printing of Plissé; manufacture of soaps, finishing compounds and wetting-out agents; analytical work; solution of mill manufacturing difficulties; dyestuffs and their application to wool, cotton, rayon; textile teaching experience; paper mill work; some sales experience; references; married; 43 years old.

A-B-C-F-1

Education — Five years chemistry and engineering, Brown University (Evenings).

Experience—1 year general superintendent at print works (shirtings, dress goods, etc.; cotton and rayon). 12 years chief chemist and superintendent of large bleachery and dyeworks (cotton, rayon and silk piece goods). 4 years chemist in charge of control work in bleach, print and dye works (cotton, wool and rayon piece goods). 9 years chief chemist and assistant superintendent in gas and oil manufacture. Practical dyer and finisher and can handle help efficiently and get results. Can help a plant seeking to improve their vat dyeing, shrinkage results, finishes and service to customers. Age 45; married.

A-C-1

Education—4 years at Newark Evening Technical School in Chemical Engineering.

Experience—8 years in manufacturing, research, testing of soaps, oils, gums and finishes and application of same in all phases of the textile industry. Age 23, single. References.

A-E-1

Education—Ph.D., Univ. of Illinois, studied chemical engineering at Columbia, licensed chemical engineer, New Jersey.

Experience—10 years' experience teaching in colleges, subjects included chemical and textile subjects. Has had broad experience in industrial work including experience in testing materials, research and consulting. Will go anywhere; references.

B-1

Education—Educated and trained in chemistry and calico printing in Glasgow, Scotland.

Experience—Has been with large print works as colorist for 13 years producing first class work on cotton, rayon, wool and silk fabrics. References.

B-2

Experience—Boss dyer with one firm for 18 years, divisional supt. at print works for 1 year, in charge of processing and dyeing of cottons and rayons at large bleachery for 6 years. Prefers bleachery in East but will go anywhere. References.

B-3

Experience—Foreman piece dyer for the past 21 years. Can dye the following: celanese, rayon, cotton backs, wool, silk and mixed fabrics. Has knowledge of finishing and laboratory work.

B-6

Education—Graduate R. I. School of Design.

Experience—5 years in bleachery, 7½ years as assistant dyer, 2 years as boss dyer and 3 years as superintendent of dyeing and finishing. Married, 33 years old. References.

B-7

Experience—Eight years as boss dyer on skeins and ribbons. Over ten years as chemist and head dyer for a large hosiery mill. Experienced on Silk, cotton, rayon and wool in skeins, ribbons, piece goods and all kinds of mixtures. Willing to go anywhere. Not afraid to work or face responsibility. Can handle help efficiently.

B-8

Education—Chemistry and Dyeing Department, Philadelphia Textile School.

Experience—Eleven years experience as chemist and boss dyer on the following: woolen, worsted and cotton yarn; woolen, worsted and union piece dyes on both ladies' and men's wear; wool, cotton, shoddy and mohair raw stock. Age 33, married, will go anywhere. References.

B-9

Experience—Hosiery dyer with fifteen years' experience on high grade silk hosiery; familiar with all types of machines. Age 43, married. Will go anywhere.

B-14

Education—Rhode Island School of Design.

Experience—Familiar with all classes of wool dyeing. Seven years with large carpet mill as dyer and processor of washed oriental rugs. Will go anywhere, married, 37 years old. References.

B-15

Education—B.T.C., Lowell Textile Institute, 1934.

Experience—Experience in dye house running washers, dye kettles and as a dye weighter.

B-17

Education—Lowell Textile Institute (Chemistry and Dyeing Course) 1916; extension courses at Brown University.

Experience—6 months dyeing wool at finishing company; 2½ years research work on bleaching, dyeing and finishing at dye works; inspector of textile equipment, U. S. Ordnance Dept., during war; 15 years as superintendent of dyeing at finishing company, including all types of colors on cotton piece goods and some rayon and celanese; handled chemical work at last named plant for many years as well as dyeing. Age 40, married, prefers East. References.

B-20

Education—Chemistry and Dyeing Dept., Philadelphia Textile School.

Experience—Thirteen years' experience as boss dyer on the following: rayon and cotton skein and piece goods and knitted fabrics. Raw stock dyeing in pressure dyeing machines. Age 35 years, married, can handle help efficiently.

Make your plans now to be in

PROVIDENCE, R. I.

on December 4 and 5 to attend

The Sixteenth

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TEXTILE WASTE TREATMENT

THE recently issued report of the Textile Foundation, Inc., concerned with "Textile Waste Treatment and Recovery" should prove of particular value to all textile wet processors. The subject is an important one for all types of industries and has become so as a result of the industrial expansion that has taken place during the last three-quarters of a century. Formerly all wastes were simply emptied into the most convenient stream and little thought was given as to the unsuitable results that might occur. However, objections arose to this practice and considerable litigation over the resultant damages caused the problem of proper waste treatment to become an important factor in the industrial picture.

A great deal of effort and thought has been given to the problem but in spite of this, stream polution has continued to increase until today the proper treatment to preserve the natural water resources has become a very complex problem. It is not that the use of water for the disposal of wastes in itself has been fought against so much as the fact that such use if not properly controlled destroys the water for other purposes. The report states that if the use of a stream for waste disposal destroys the value of the water as a source of water supply, offends the senses and endangers health, development in the area through which the polluted stream flows will be hindered and in some cases growth will stop entirely unless the water is restored to a reasonable degree of purity and is conserved in this degree of purity by the united efforts of all interested parties.

The treatment of textile mill wastes is a particularly acute problem inasmuch as there are not two textile wastes that are alike in character, and no two textile wastes can be treated by exactly the same purification process. The combined waste from each mill is different and the waste from any one mill continuously changes with the introduction of new processes or the change in market demands. Because of these differences it becomes apparent that the treatment of the waste from each mill becomes an individual problem and must be studied carefully for the proper solution. In spite of the difficulties encountered in treating textile wastes many of the mills have developed satisfactory processes for purification of the effluent.

One of the obstacles in the treatment of waste matter is of course the cost. In some industries the recovery of by-products enables the plant to profit from the proper treatment of the waste but this is not particularly true in the case of textile plant waste treatment. However, there are instances where such recovery has yielded products suitable for re-use which has reduced the expense of disposal.

The purification of dye wastes can generally be accomplished by chemical precipitation methods. In regard to this subject the report summarizes as follows:

"Chemical precipitation methods have been found to provide satisfactory and usually sufficient treatment for wastes which are not exceptionally high in organic content, e.g., wastes from dyeing and finishing operations, while chemical precipitation followed by mechanical filtration or biological purification is generally required for the wastes containing large amounts of organic matter, e.g., wastes from detergent operations. Soaps, oils and waxes in a waste interfere with chemical precipitation. Certain dye wastes which do not respond to chemical precipitation must be purified by bleaching or by using an absorptive material to remove the color. The cost of treating a waste by chemical precipitation generally lies between 10 and 20 cents per 1,000 gallons. The satisfactory operation of any treatment plant depends on scientific and conscientious control."

The report further states that "each textile waste disposal problem involves so many complicating factors that its solution must not be undertaken hurriedly. The requirements in each case must provide for justice and must be founded on sound principles of economic conservation. A thorough study of the technical phases of each problem is necessary. The solution of these complex problems can be attained only by continuous endeavor and by sympathetic cooperation on the part of both the manufacturer and the authority."

Considerable work on the problem has been done by many of the states which have to deal with the treatment of textile wastes and many of the problems have been solved. However, much of the information obtained has been of value only to individual mills. The coordination of this information and its dissemination will prove valuable. Much information of a general nature is still needed, although as indicated above this information can only be used as a basis for treatment in individual mills.

ANNUAL MEETING
A.A.T.C.C.
Providence, R. I.
December 4 and 5

Some Uses of The Calender in Finishing*

Finer and More Uniform Fabric Appearance

THE calender, of whatever type it may be, is particularly useful in the finishing of all kinds of fabric because it is adapted to utilize the important property of all textile fibers of being plastic under the combined influence of heat, moisture, and pressure. This plasticity can be utilized in a number of ways, but especially in a final treatment of textile materials so that they may be left in a condition attractive to the purchaser.

A calender may be constructed in a number of different ways according to the purpose for which it is likely to be used, but essentially it consists of at least two bowls driven at the same or different speeds and pressed together to an extent which can be varied widely. Usually one or more of the bowls is steam-heated internally. Thus, fabric passing between the two bowls is heated and pressed under conditions which cause its "moisture of condition" to render it plastic. The general effect of this treatment is to flatten the surface of the fabric so that it has a more compact and lustrous appearance.

Today the cotton poplin-type colored stripe shirt fabric is very popular and is now being manufactured in a wide variety of qualities, but in almost every instance it is desired that the finished fabric should have a silky handle and a high luster. The most satisfactory method for securing this result consists of mercerizing the fabric to secure a high luster and then finishing it so as to show this luster to the utmost without flattening the surface too much. At the same time it is generally desirable that the fabric should be as fully shrunk as possible so that shirts and collars made from it retain their original size after the numerous washings to which such a garment is generally subjected.

In processing such a shirting fabric, it will, after mercerization, be thoroughly washed, soured, washed, and again soaped for the purpose of brightening the colored stripes. It will then be impregnated with a softening agent and stentered to width on a hot-air stentering machine. At this stage the fabric has a somewhat rough surface so that it requires calendering to give it that smoothness of touch which makes the cotton more silky. But here is a problem. If the fabric is calendered while containing its usual moisture of condition the effect of calendering will be beneficial as regards handle, but it will simultaneously cause an extension in length of the fabric.

This increase of length is obviously due to a pressing-out of the fabric and may amount to 2 to 3 per cent. To be satisfactorily guaranteed unshrinkable the fabric should not shrink more than about one-half of one per cent, so that calendering under ordinary conditions will thus be impossible. The difficulty is surmounted by calendering the fabric while in a drier condition than is usual, that is, while containing about 3 per cent of moisture instead of the usual 6 per cent. Under these conditions the fabric surface is smoothed without being flattened and extended in length.

A comparatively simple manner of effecting calendering under these conditions of restricted moisture content consists of leading the fabric over a hot steel or sheet-iron cylinder immediately before it passes through the calender.

Another important use of the calender is in connection with the finishing of rayon crepe fabrics and also rayon taffeta fabrics made with viscose and acetate rayons. After dyeing, it is usual to stenter the rayon crepe in its wet condition on a hot-air stenter. When the fabric leaves the stenter it often has a firm paper-like handle according to the degree of stretching to which it has been subject, and, of course, this finish is quite unsuited to a crepe fabric. It is thus necessary to soften the fabric in a manner which does not eliminate the pebble appearance. For this, a calender consisting of a steel bowl running against a hard cotton or paper bowl is not suitable, since the fabric would be flattened too much. It is much better to use a calender with a wood bowl running against a soft metal bowl such as copper. Alternatively, a good softening of the fabric can often be secured by passing the fabric between two rubber bowls having a moderate degree of hardness. The two bowls should definitely run at the same speeds.

It is sometimes noticed with viscose-acetate rayon taffeta fabrics (usually dyed in two colors and widely used for bedspreads and decorative hangings) that they show scratch marks when rubbed with the thumb nail or other pointed object. The marks appear to show distinctly on account of the surface of the fabric being disturbed, so that the rubbed portion has a luster differing from that of the surrounding fabric. This is considered a definite fault in fabrics of this type and must be remedied. The presence of soap residues in the fabric have been found to contribute towards this fault, but not to be entirely responsible. As a matter of fact, a really satisfactory

*Reprinted from Textile Mercury and Argus.

reason for the fault is not yet known. But it has been established as an experimental fact that the defect can be almost entirely eliminated by ironing the fabric.

The method of correcting the fabric thus lies in a calendering process. For this, only a moderate pressure should be employed since acetate rayon is much more plastic than viscose rayon or cotton. A satisfactory treatment consists of running the fabric through a calender comprising a steel bowl internally heated with steam and a soft cotton bowl, the pressure between the two bowls being reduced to just the minimum amount found sufficient to make the fabric resistant to thumb marking.

With cotton fabrics it is sometimes desirable to produce a lustrous appearance without going to the expense of mercerizing. In such cases a final calendering is most likely to give the desired result. But unfortunately a bright calender finish suffers from two defects. Firstly, it is not fast to water and is removed by the first wash, and secondly, a luster obtained with a calender often has a somewhat glazed appearance and this is unattractive. In contrast, the luster produced by mercerization is shown throughout the fabric even in the hidden threads.

It has been found that the calendering increased luster effect is much more permanent when the cotton fabric is treated in a wet instead of a damp condition. Some four or five years ago there was introduced a specially heavy and powerful calender suitable for calendering under these exacting conditions. Cotton fabric, in a wet condition immediately after scouring or bleaching, is led continuously between a lower hot steel bowl and a central cotton bowl and then between the same cotton bowl and an upper gas-heated steel bowl, the bowls being pressed together under very high hydraulic pressure. The temperature of the upper bowl is quite high so that the fabric leaves the machine almost dry.

By a special arrangement the cotton bowl is slightly skewed in a horizontal plane so that the fabric is subject to a small amount of surface friction. In these circumstances the fabric receives a very high glaze (much higher than in ordinary friction calendering) and furthermore, owing to the fact that the wet fabric has been dried while being calendered, this glaze is moderately permanent. The fabric can, therefore, be afterwards washed so that the glaze is reduced to an appearance closely resembling that of mercerization.

In conclusion it may be mentioned that by calendering crepe fabric under suitable conditions in its grey state, it is possible to modify its behavior during the creping process. This applied particularly to viscose-acetate rayon fabrics. The effect of the calendering treatment is to restrict the latent shrinkage forces in the crepe yarns. Thus by this treatment it is possible to ensure the production of a finer and more uniform crepe appearance.

—♦♦—

The Unshrinkable Finish on Wool Material*

HITHERTO, interest in the reactivity of wool towards halogens has been largely confined to chlorine. This is obviously because it is by chlorination that wool materials can be made practically unshrinkable, and this technical application of a halogen to wool has been carried on during many years with a considerable amount of success.

More recently, however, attention has been drawn to the use of bromine instead of chlorine and it has actually been shown by Trotman and Bell (*J. Soc. Chem. Ind.*, 1935, *54*, 30T) that except from the view point of cost, bromine would be a good substitute for chlorine in the unshrinkable finish. Now comes fresh information indicating that iodine is also reactive towards wool, and owing to its special properties this halogen appears to lend itself better than chlorine and bromine for research on the behavior of wool under halogen treatment. It seems that by careful investigation of the action of iodine on wool much may be learned of the mechanism of the chlorine unshrinkable finish.

For many years iodine has been used in analytical processes for determining the degree of unsaturation of various oils, and the iodine number of an oil is a valuable index of its composition and purity. Standard methods have been devised to determine this iodine number and among these the Wijs method is well known. When an oil, say linseed oil, is shaken with the special iodine solution, combination takes place and the solution becomes decolorized. In such cases combination takes place by simple addition of the iodine to the unsaturated linkages thus:—

$$R.CH=CHR + I_2 = R\overset{I}{C}H—\overset{I}{C}HR.$$

But when this same treatment is applied to wool the decolorization of the iodine must be due to some other

*Reprinted from *Textile Mercury and Argus.*

reaction since the wool substance contains no unsaturated linkages; so far as can be ascertained the iodine joins itself to the amino groups while a proportion may oxidize in SH group in the cysteine constituent of the wool. But a return will be made to this aspect of the phenomena later.

When scoured and purified wool is immersed in a solution of iodine, the wool absorbs the iodine so that the surrounding solution gradually becomes weaker. According to R. Haller and F. W. Holl (*Textilber.*, 1936, *17*, 493) this absorption continues for several hours, but using an iodine solution containing from 1.9 to 12.9 grams of iodine per liter and prepared by dilution of a stronger solution made with:—

Iodine	10 grams
Potassium iodide	15 grams
Alcohol	200 c.c.
Water	800 c.c.

equilibrium is reached at the end of about 15 hours.

Actually, only part of the absorbed iodine chemically combines with the wool, but both the chemically combined and the merely absorbed iodine are very strongly held. For example, if the iodine saturated wool be exposed to 150 C. it does not completely lose the iodine (by sublimation) during four days. Treatment of the wool repeatedly with boiling water removes the absorbed iodine and leaves the wool a pale yellow color due to the presence of chemically combined iodine; if this well-washed wool be now dried and weighed its increased weight can be used as a measure of the iodine in chemical combination with the wool. Haller and Holl, using this method and a solution containing 9.17 grams of iodine per liter obtained sufficient data to construct the curves shown in Fig. 1.

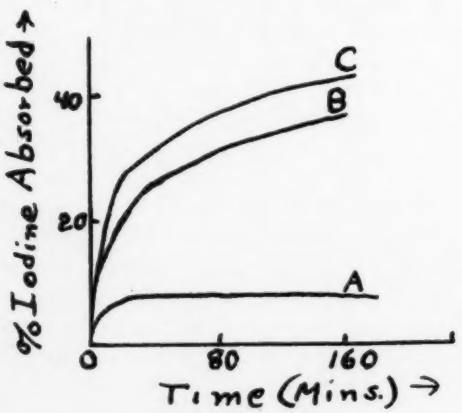


Fig. 1

A = Chemically combined iodine curve
B = Absorbed iodine curve
C = Total iodine absorption curve

The curves indicate that iodine absorption takes place very rapidly within the first few minutes (this will vary, of course, with the strength of the iodine solution) and that when chemical combination to the extent of 6.5 grams of iodine per 100 grams of wool has taken place, further absorption goes on.

The following data shows how the total absorbed iodine varies with the strength of the iodine solution:—

Concentration of iodine solution	*Iodine absorbed by wool*
1.91 grams per liter	13.6 per cent
9.17 grams per liter	38.1 per cent
12.93 grams per liter	44.7 per cent

Yet, however strong the iodine solution, the amount of chemically combined iodine found in the resulting wool remains constant at about 6.5 per cent.

It is reported that the iodine treated wool (after removal of the merely absorbed iodine by washing) does not give a blue color with starch solution, and that the iodine content is quite fast to alkali treatment and also to light. It is suggested that reaction between the wool and iodine occurs thus:—

$$X.NH_2 + 2I_2 = X.NI_2 + 2HI$$

it being known that wool has a composition corresponding to $X.NH_2$ since the amino group (NH_2) can be diazotized and the wool then coupled with naphthols to give a reddish-brown color.

Alternatively, any substance of the type $X.NH_2$ is known to form compounds with acids thus—$X.NH_2.HCl$, and it may be, as considered probable by H. Phillips (*J. Int. Soc. Leather Trade Chemists*, 1933, *17*, 151) that the iodine is united to the wool in this same manner, that is, as an additional compound.

Now it would, at first sight, be considered that if wool combines chemically with iodine it would do so however the iodine were applied, but this is not so. When applied in the form of an aqueous solution behavior of wool towards iodine takes place as described above. When applied from solution in an organic solvent the reaction is erratic and varies with the solvent. Thus Haller and Holl report that while the wool readily absorbs and combines with iodine from a solution in alcohol, it does so to a less extent from a solution in chloroform, and only very slightly with iodine solutions in benzene, toluene, and carbon disulfide. It is evident that the presence of water plays a large part in the reaction.

This influence of moisture in modifying the behavior of wool towards halogens is also experienced with chlorine. It has been found that in the unshrinkable finish, wool shows less activity towards chlorine as moisture is removed from the reaction; dry wool is more difficult to make unshrinkable than is moist or wet wool. On the other hand, the presence of moisture can assist the rapid deterioration of the wool during chlorination. Since iodine is less destructive towards wool than is chlorine, it would, therefore, appear that by using iodine it will be possible to better establish the course of the reaction of wool towards chlorine.

According to H. von Hove (*Zeit. angew. Chem.*, 1934, *47*, 756; *Textilber.*, 1933, *14*, 601) the presence of mois-

ture in wool enables the halogen to attack the wool substance and cause hydrolysis with consequent decomposition. In the unshrinkable finish, this course of reaction is not desirable since it inevitably leads to an impoverished wool having decreased durability.

The behavior of wool towards iodine has also been studied by M. Harris, H. Neville and W. C. Fritz (*Amer. Dyestuff Rep.*, 1934, *23*, 323) using a slightly modified Wijs solution and proceeding along lines to establish the iodine number of wool. Assuming that wool contains 5.7 to 9.2 milligrams of amino nitrogen per gram of wool then it can be calculated that the iodine number of the wool should be 10.3 to 16.7; by experiment it is found to be about 8.3 to 9.4.

Now the wool substance not only contains amino groups (NH_2) but also SH groups, which are liable to be oxidized by the iodine; the iodine number of wool is thus liable to be higher because of the amount of iodine which may be utilized in the oxidation. But there is a method by which the iodine number, due to the presence of amino groups in wool, can be determined approximately, since it is known that the amino groups can be destroyed by treating the wool with nitrous acid. Thus, if the iodine number of wool be determined before and after treating the wool with nitrous acid, then the difference between the numbers thus found will be due to the amino groups. It is by this procedure that the iodine number of 8.3 to 9.4 given above was determined.

Below are given the iodine numbers of several nitrogenous compounds allied to wool:—

Substance	Formula	Iodine Number
Glycine	$CH_2NH_2.COOH$	15.5
Glycollic acid	$CH_2OH.COOH$	0
Glycine hydrochloride	$CH_2NH_2.COOH.HCl$	0
Leucine	$CH_3(CH_2)_2CHNH_2.COOH$	20.6
Acetamide	CH_3CONH_2	0
Urea	$CO(NH_2)_2$	0
Cystine hydrochloride	$CH_2SH.CHNH_2COOH.HCl$	89
Hippuric acid	$C_6H_5CONHCH_2COOH$	0

By considering the iodine number in relation to the structural formula of the above compounds it will be concluded that iodine reacts only when there is a free amino group and that the group—$CONH_2$ is non-reactive. Reaction between iodine and an amino compound appears to be more complete as the molecular weight of the substance increases. Thus Harris, Neville and Fritz point out that the iodine numbers of glycine and leucine should, theoretically, be 338 and 194 respectively. The iodine number of cysteine hydrochloride due to its amino group should be nil; the value 89 must, therefore, be ascribed to oxidation of its SH group and this seems reasonable since their theoretical value for this would be 83.

Technical wet processing of wool produces chemical changes in the wool substance and it might be considered that these changes would influence the iodine number of the wool. As a matter of fact this is so and the following data illustrate this point.

Treatment of wool	*Iodine Number*
Raw wool, scoured with solvents	14.2
Overscoured with 1 per cent soda ash at 70° C.	14.2
Treated with 1 per cent formaldehyde	5.9
Bleached with neutral 1 per cent hydrogen peroxide	14.1
Bleached with alkaline 1 per cent hydrogen peroxide	4.3
Bleached 8 hours with acid 1 per cent $KMnO_4$	1.5
Diazotized with 0.1 per cent nitrous acid at 25° C.	4.7
Diazotized with 0.1 per cent nitrous acid at 0° C.	4.8

It is here evident that all treatments of wool which tend to oxidize the SH groups or destroy the amino group have the effect of reducing the iodine number.

So far, no report has been given by any of the above investigators as to whether or not iodine treatment reduces the felting property of wool; that remains for further experiment. If it does, then the importance of further investigating the action of iodine on wool is definitely increased. But, in any case, it would seem that by following up these new disclosures concerning wool and iodine a better understanding of the chlorine unshrinkable finish will be reached.

Rules Designed to Prevent Kier Accidents

(Continued from page 486)

(b) The pumps or other means by which the movement or circulation of liquor in that kier system is effected, have been secured to prevent such circulation.

Provided also that in the case of entry into a kier for the purposes of examination, repair, limewashing, or any similar purpose in connection with maintenance, the foregoing requirements shall not apply, but instead thereof the following requirements shall apply:—

(3) It shall be the duty of the foreman or person in charge of the persons engaged in the above-named work, to take all reasonable care to ensure that no person shall enter or remain in a kier unless:—

(a) All valves or taps which control the admission of steam, liquor or hot water into that kier have been closed, or adequate isolation has been effected by disconnection.

(b) The pumps or other means by which the movement or circulation of liquor on that kier system is effected, have been secured to prevent such circulation.

(20) *Prohibition of Unauthorized Entry.* No person may enter a kier for the purposes of plaiting down, filling, arranging, packing or emptying cloth, yarn, lace, loose cotton, or other textile material without the consent of the authorized person, as indicated by the affixing of the notice or sign required by Rules 19 (1) (g). Provided that this Rule shall not apply in the case of a kier to which Rule 19 (1) does not apply.

(21) *Prohibition of Standing or Sitting on Edge of Kiers.* No person may sit or stand on the edge of an open kier or on the fencing around it.

Raw Wool Washing*

With Special Reference to the Fundamental Principles of This Process

H. PHILLIPS, D.Sc., F.I.C.†

MERINO wool, as clipped from the sheep, is frequently contaminated with over 50% of its weight of grease, suint, dirt and vegetable matter. The bulk of these materials must be removed before the wool can be washed in the usual meaning of the term, and in most mills this is done in the first bowl of the scouring set, after the wool has been steeped in either cold or warm water. In the second and third bowls, the wool is washed clean with soap and soda, while in the last bowl it is rinsed with water.

A survey of the effect of alkaline solutions on clean wool, and of the influence of the *p*H values of soap solutions on their detergent properties, suggests that the maximum alkalinity of the liquors in bowls 2, 3, and 4, in which the partly cleaned wool is washed, need not greatly exceed *p*H 10. Special conditions apply in the steep bowl and the first wash bowl in which the bulk of the grease is emulsified by the suint. Very little information is available concerning the *p*H values at which the liquors in these bowls will give the best results.

Neither alkali nor soap is normally added to steep liquors. Their *p*H values are, therefore, determined by the suint. In order to determine the *p*H values of water extracts of raw wool samples nearly a hundred different fleeces of Australian origin were examined in the following manner. A ten gram sample of each fleece was immersed for ten minutes in 100 c.c. of distilled water at 120° F. and the *p*H value of the cooled water extract was then determined with the glass electrode. The *p*H values of the water extracts of the first fifty-four samples examined in this way ranged from 5.50 to 8.41.

The combined amounts of suint and grease, their degree of acidity or alkalinity, and their relative proportions in raw wools can vary for many reasons, and hence the *p*H values of the liquors obtained when the wools are cold steeped may vary within fairly wide limits. The following data due to Bonsma and Starke gives some idea of the normal quantities of suint and grease in merino wool and indicates how the combined amounts and the relative proportions of each may vary with the position of the wool in the fleece.

Average Suint and Grease Contents of Wool of 12 Mature Merino Wethers Over a Period of 15 Months

Area	*Suint, %*	*Grease, %*
Shoulder	12.2	21.5
Midrib	13.4	21.9
Thigh	12.3	22.6
Withers	11.8	21.6
Rump	12.5	21.9
Belly	18.6	13.8

Wool from cross-bred sheep contains smaller amounts of suint and grease, while mohair and alpaca contain much smaller amounts.

The *p*H values of the water extracts of normal untreated raw wools are lower than those of the soap solutions used in the laboratory (*p*H 8-10) which were found to give the lowest surface tensions and to have the highest emulsifying powers. Possibly this is advantageous from the standpoint of the efficiency of the cold-steeping process, since this process is uually adopted in order to give the gross mineral and soil impurities in the wool an opportunity to drop out, so that they do not contaminate the grease removed in subsequent bowls. If the natural *p*H value of such a cold-steep liquor were raised by the addition of alkali, greater quantities of suint would be removed and more grease would be emulsified and become contaminated with dirt.

When it is desired to remove as much grease as possible in a warm steep liquor or in bowls run on the Duhamel principle, the *p*H values of the liquors must be raised above the usual *p*H values of solutions of suint in order to convert the free fatty acids in the raw wool into soaps. The amounts of free fatty acids in the suint and grease of merino wool are appreciable. Freney found that the suint extracted from merino fleeces with warm water contained up to 20% of its dry-weight of saturated organic acids varying in molecular weight up to 260 (palmitic acid 256). Similarly Drummond and Baker found 4.1% of free fatty acids (calculated as stearic acid) in the greases extracted from raw wool with petroleum ether, while the greases extracted by this solvent from crude merino wool by Abraham and Hilditsh had an acid value of 7.5.

In order to obtain quantitative data concerning the amount of alkali required to bring raw merino wool into equilibrium with solutions of *p*H 10, a further group of 32 merino fleeces, all from the same flock, were examined as before, and, in addition, the alkali requirement of each sample was measured by the following titration method. A 10 gram sample was taken and immersed in 100 c.c. of distilled water for 10 minutes, the temperature being maintained at 120° F. The liquor was then squeezed out by placing the wool in a cylindrical separating funnel and comprising it by means of a wooden plunger, after which the expressed liquor was cooled and its *p*H value was measured. It was then titrated with 0.2*N* sodium hydroxide until the *p*H value was just above 10, and was

*Reprinted from Textile Recorder.
†Wool Industries Research Association.

TABLE 1

Alkali Requirements of Some Merino Fleeces

pH Value of Fleece	*Pounds of Soda required to bring to pH 10. 1,000 lbs. Raw Wool*	*Suint only*
4.92	8.0	3.0
5.50	5.4	2.4
5.73	10.4	3.6
5.90	12.5	3.8
6.02	7.1	2.7
6.17	7.2	3.2
6.22	8.8	3.6
6.32	8.5	3.1
6.37	8.1	2.9
6.45	6.6	3.5
6.48	7.5	2.7
6.54	7.6	3.1
6.83	7.3	3.2
6.86	7.6	2.7
7.08	5.7	2.2
7.24	5.0	2.2
Average : less than 6	9.3	3.4
Average : 6-7	7.9	3.2
Average : over 7	5.5	2.2

then allowed to percolate through the wool again for 10 minutes. At the end of this time it was squeezed out, the *p*H value measured, and 0.2 c.c. of 0.2*N* alkali added to the liquor, which was then allowed to percolate through the wool again for a further period of ten minutes. This procedure was repeated until the liquor expressed from the wool had a *p*H value greater than 10. The measured *p*H values were plotted against the amount of alkali added and the quantity of the latter required to bring the raw wool to equilibrium with a solution of *p*H 10 was thus determined. Table 1 records half of these measurements and averages for the complete group of 32 fleeces. It will be seen that the lower the *p*H value of the water extract of the fleece, the greater the amount of alkali (calculated as sodium carbonate) required to bring the raw wool to equilibrium with a solution of *p*H 10.

As shown by Freney, a suint liquor contains many constituents not found in normal soap liquors, and it is therefore possible that they can act as efficient emulsifiers of wool grease at *p*H values below 10. Information bearing on this point was obtained by determinations of the drop-numbers of some commercial steep liquors maintained at 120° F. A similar experimental procedure was adopted to that used for the measurements on soap solutions. The *p*H values of suint liquors were adjusted by the addition of sodium hydroxide solution. The results showed that the emulsifying powers of liquors A1 and A2 are definitely superior to those of the most concentrated of the soap solutions examined, the curve becoming vertical at *p*H values well below those at which the curves of the soap solutions become vertical

THE ASSESSMENT OF SUINT LIQUORS

The influence of the *p*H value on the emulsifying power

TABLE 2

Liquor	*pH*	*Total Solids* (% of that present in uncentrifuged liquor)	*Grease* (% of that present in uncentrifuged liquor)	*Soap* (% of that present in uncentrifuged liquor)	*Earthy Matter* (% of that present in uncentrifuged liquor)
1	7	53.2	35.5	45.5	84.5
	8	59.5	42.1	65.7	84.0
	9	65.5	42.7	80.0	86.5
	10	66.2	41.8	87.5	78.2
2	7	45.1	33.3	49.4	77.0
	8	49.5	35.0	54.8	72.3
	9	52.0	37.2	55.6	67.4
	10	46.0	33.6	56.6	62.5
3	7	45.0	41.5	46.5	94.0
	8	52.6	43.9	52.6	89.0
	9	56.6	44.5	54.2	88.1
	10	61.7	45.0	59.5	75.0

of some suint liquors was also assessed by the determination of the amounts of grease remaining emulsified in the liquors after they had been centrifuged. Determinations were also made on the amounts of earthy matter that remained in suspension in the different liquors. Three liquors were examined having respectively *p*H 8.64, 8.77 and 9.57 when withdrawn from the bowls of three scouring sets. Each liquor was titrated with acid and with alkali using the glass electrode, in order to determine the amount of either reagent necessary to bring it to various *p*H values. Two liters of each liquor were then maintained at 120° F. on a water-bath and continually agitated with a mechanical stirrer while 25 c.c. samples were withdrawn. These were adjusted to various *p*H values, lying between 7 and 10, kept at 120° F. for one hour, and were then centrifuged. This caused part of the solid dirt to settle to the bottom of the centrifuged tube and part of the grease to collect at the top. Ten c.c. of the liquor were withdrawn from the middle portion of the tube, and evaporated to dryness in a weighed crucible and dried to constant weight at 105° C. This gave the weight of the total solids in suspension; the residue was extracted with petroleum ether, dried, and the loss in weight recorded as grease. It was then extracted with alcohol and the further loss in weight recorded as soap. Finally, the residue was ignited at red heat and the weight of ash recorded as a measure of the mineral dirt or earthy matter present. The analytical data is recorded in Table 2, the amounts of total solid, grease, soap and earthy matter (determined as ash) being recorded as percentages of the amounts present in the original uncentrifuged liquor, determined by the same method of analysis. It will be noticed that whereas the optimum *p*H value for the suspension of earthy matter is towards the less alkaline end of the range studied, that for grease is about *p*H 9. Even in the more alkaline liquors, however, the percentage of earthy matter remaining in suspension is about twice that of the grease. The results of these experiments, therefore, suggest that 9 is the best *p*H value for suint liquors. At this *p*H values less earthy matter may remain in suspension than at lower *p*H values, but the stability of the grease emulsion will be at a maximum.

TECHNICAL NOTES FROM FOREIGN SOURCES

Azo Dyestuffs (Complexly Substituted)

German Patent No. 493,811 (*March* 15, 1930).—*Geseltschaft. f. Chem. Ind. in Basel.*—The general formula for the products considered in this specification may be given as $R_1—N=N—R_2—NH—C=X—NHR_3$, in which formula R_1 signifies the radical of an alpha-naphthol, R_2 the residue of a benzene or naphthalene derivative, R_3 the residue of any desired aromatic component, which contains at least one azo linkage, and X signifies an oxygen atom or sulfur atom. Further, in R_1, the hydroxyl of the alpha-naphthol radical must be in the peri position to the first azo linkage, the azo linkage standing in the 4-position to the NHC=X group of the next component.

The synthesis really consists in linking together two amino-azo compounds (as such or in posse—see below) through the amino groups, by the reaction of phosgene, thio phosgene, carbon disulfide, or substances of similar action and nature, the products fundamentally being ureas or thio-ureas, complexly substituted.

Of these two amino components, at least one

a—must be an amino-azo compound derived by diazotizing 1-amino-8-naphthol or a derivative of it, and coupling to such an amino-derivative of the benzene or naphthalene series as will permit being coupled to in the 4-position of the amino-group.

b—If the two components are not of the type a, the other component consists of any desired amino-azo, amino-disazo, or amino-tris-azo-dyestuff, or of some compound such that, after the urea formation with component a, it can be diazotized or coupled to by a diazo-component, so that it is then converted to such an azo dyestuff, its amino group being already ureated.

Under these possibilities specified, there are four points to be noted:

bb—after union to the urea condition, an acidyl radical may be split off by hydrolysis, as, for example, if the aryl ester of 1-hydroxy-8-naphthylamine was the component R_1, so that there is a peri hydroxyl free in that component.

bc—there is the possibility of using as the second component a substance not already an amino-azo dyestuff, but an amino component, which can, after the phosgene condensation, be diazotized and coupled to a desired second component, thus converting the second member of an azo dyestuff residue; or which can serve as a passive component to which is coupled a suitable diazo-compound for the same purpose (in which case the OH of component R_1 would have to be in the acylated condition to this point, to prevent its attracting the coupling to take place in the 4-position to it).

bd—the components, in any way produced, may be converted to metallic derivatives (e.g., pre-coppered).

be—the above possibilities may be combined selectively or wholly in any sequence desired.

The products dye both vegetable fibers and silk in very level tones, the dyeings are very fast to light, and are very sensitive to discharge printing (perhaps, rather more exactly, are very responsive). Their range covers the whole spectrum except green, which is not covered by the group. Those of the products which contain the ortho-hydroxy-azo or otho-hydroxyl-carboxyl groupings are especially easily metallized by salts of copper, previous to dyeing, or after dyeing also; by which the fastness of the dyeings is still further increased. Such a metal content may be introduced also by using a metal-containing component in the synthesis of the dyestuffs.

Three examples are given, in great detail.

Orange Vat Dyestuffs (Anthanthrone Series)

German Patent No. 492,344 (*February* 21, 1930) (*addition to G. P. No.* 458,598 *of November* 9, 1925)—*L. Cassella & Co.*—The original patent covers a method of converting anthanthrone to orange vat dyestuffs by the action of halogen (chlorine or bromine) upon anthanthrone, the conditions being of a mild nature. The present supplement describes the carrying out of the reaction under somewhat more vigorous conditions, namely, by acting upon anthanthrone with chlorine in sulfuric acid, of 85 to 95 per cent, as a medium. The method claims the advantage that the desired product separates, as formed, from the medium in an insoluble, crystalline condition, as the sulfate, while by-products remain in solution.

For example, one part of anthanthrone is dissolved in 10 parts of conc. sulfuric acid, and so much water then added that a 90 per cent sulfuric acid is formed; then a suitable carrier is added, such as a little iodine, ferric chloride, ferrous sulfate, etc., and chlorine is passed in at 45°-50° C., with stirring, until a test-portion, after cooling and filtering, no longer shows the presence of anthanthrone in the solution. The whole is then cooled, the violet-black, crystalline deposit separated by filtration or centrifuging, washed with 85 per cent sulfuric acid until the washings run off colorless, then stirred up with water, filtered, and washed until the washings are free from acid, then dried. The product is an orange powder, soluble in conc. sulfuric acid with a green color, vatting in hydrosulfite to a violet solution, the dyeings therefrom on cotton oxidizing to a brilliant yellow-orange.

Orange Vat Dyestuffs (Anthanthrone Series)

German Patent No. 495,368 (*April* 5, 1930) (*addition to G. P. No.* 458,598 *of November* 8, 1925).—*L. Cassella and Co.*—The principal patent and supplementary ones cover the preparation of orange vat dyestuffs, by halogenation of anthanthrone under mild conditions (see above previous abstracts on this topic). The present procedure proposes the halogenation of anthanthrone-sulfonic acids,

in such a way that the halogen displaces the sulfonic group. The advantage claimed for this method lies in the fact that the sulfonic acids are soluble in water, and the reaction can therefore be carried out in aqueous solution, at moderate temperatures.

For example, anthanthrone is converted to its monosulfonic acid by treatment with fuming sulfuric acid as usual (the product forms brownish-orange crystals, soluble in concentrated sulfuric acid with a brownish-red color). One part of this is dissolved in 100 parts of 4% HCl, the solution heated to about 90° C., and an aqueous solution of sodium chlorate slowly run in, until the reaction is complete. As the sulfonic group is split off and replaced by chlorine, the chlor-anthanthrone formed separates from the mixture, and on completion of the reaction the yellow-orange solution becomes colorless. The product is filtered off, washed, and dried. It may be purified by recrystallization from chlorbenzene, and forms a crystalline powder of a reddish-brown color, soluble in conc. sulfuric acid with a green color. It vats in hydrosulfite to a red-violet color; cotton dyed in it oxidizes in a soap bath to a brown orange.

Five examples altogether are given.

Vat Dyestuffs (Pyranthrone Series)

German Patent No. 493,408 (*March 7*, 1930).—*I. G. Farben-Ind. A.-G.*—The reaction here protected consists in subjecting halogenated pyranthrones to the action of sulfurizing agents, usually in the presence of suitable diluting-agents.

For example, 5.6 parts of brominated pyranthrone (see British Patent No. 282,481) are stirred up with 3 parts of potassium xanthogenate in 100 parts of amyl alcohol, and refluxed for about six hours. On cooling, the deposited dyestuff is filtered off and washed. The product is a yellowish-brown powder, soluble in conc. sulfuric acid with a blue color, and giving with hydrosulfite a violet vat, the oxidized dyeings on cotton being a bright yellowish-brown, of very good fastness properties.

If the quantity of xanthogenate is increased, or benzyl alcohol used in place of the amyl alcohol, the product is somewhat redder; as is the case when the amyl alcohol procedure is carried out under pressure.

Six examples altogether are given. The higher the reacting temperature, and the higher the degree of halogenation of the pyranthrone, the redder are the products, in most cases. The vats are from red-violet to blue-violet, the dyeings on cotton are browns, varying in tone from yellowish to reddish.

Vat Dyestuff Intermediates (Benzanthrone Series)

German Patent No. 495,366 (*April* 5, 1930).—*British Dyestuffs Corp. Ltd.*—The process here cited consists in sulfonating benzanthrone or methyl-benzanthrone with sulfuric acid of any suitable strength, concentrated, monohydrate, or oleum, in the presence or absence of a catalyst; and fusion of the products with caustic alkali. Seven examples are given.

Brown Vat Dyestuffs (Anthraquinone Series)

German Patent No. 496,078 (*April* 17, 1930).—*I. G. Farben-Ind. A.-G.*—By the action of 1-chlor-, 1-nitro-, or 1-diazo-anthraquinone-2-carbonic acids upon mercapto-compounds of the anthracene series, anthryl-1-thio-anthraquinone-2-carbonic acids can be prepared. Such compounds, by the action of suitable acid condensing agents, can be easily converted to the corresponding thio-xanthones. Such products would be expected, by analogy with similar simpler compounds, to be yellow to orange vat dyestuffs, but they dye cotton brown—strong, yellowish browns of very good fastness in general.

For example, 4.6 parts of beta-anthryl-1-thio-anthraquinone-2-carbonic acid are heated in 60 parts of trichlorbenzene as a medium, with 3.1 parts of phosphorus pentachloride, for about three hours, in the waterbath, and finally for a short time at 200° C. On cooling, the product which separates is filtered off, washed with chlorbenzene, then with acetone, and boiled out with dilute sodium carbonate solution. It forms a dark-brown powder, soluble in conc. sulfuric acid with an olive color; its hydrosulfite vat is green, Cotton is dyed yellowish brown, of good fastness.

Influence of Inorganic Salts (Neutral) upon the Mordanting Process in the Steamer

Dr. P. Sazanoff and K. O. Swetliakoff—Monats. f. Textil-Ind. 49, 66, 88, *and* 113 (1934).—Baths for padding goods, and printing pastes, as far as the mordant dyestuffs are concerned, contain in most cases a more or less large quantity of neutral salts, as sodium sulfate, sodium chloride, sodium acetate, barium nitrate, calcium nitrate, etc., beside the mordant and the dyestuff. Such salts are not without influence upon the state of solution of the salts of aluminum and trivalent chromium, present in solution. Some of these salts have been specially studied; Bierrum, Dehnkem, Ohli, and Sand and Grammling have investigated the hydrolytes of aluminium and chromium salts, in reference to the influence of concentration, temperature, and addition of hydroxyl ions upon their solutions. The results of these studies have made possible the theory held at present of the hydrolysis and the hydrolysis-constants of aluminium, chromium, and ferric salts, and have had their effect upon recent views regarding the molecular structure of salts of these metals. Prof. Povarnin has also studied the effect which the neutral salts, sodium sulfate and sodium chloride, exert upon the hydrolysis of the sulfates and chlorides of aluminium and chromium. Povarnin's results may be briefly summarized by the statement that, through the addition of the neutral salts, sodium sulfate and sodium chloride, the hydrolysis of aluminium and of chromium salts, the chlorides and the sulfates, is strongly depressed.

It has appeared worth while to the authors to consider whether such depression of hydrolysis might not be found to hold good in the case of the acetates of the metals of the aluminium group, since the acetates of aluminium, chromium and ferric iron are largely used in mordanting: and it

seemed also worth while to consider the question in particular reference to its bearing upon mordant dyeing.

The salts studied were the acetates of chromium, and of aluminium, of the type $M_2 (C_2 H_3 O_2)_6$—that is, the normal acetates.

Chromium acetate was first studied in this connection. Rather than employ a sample of uncertain composition, the acetate employed was prepared by dissolving precipitated and carefully washed chromium hydroxide in acetic acid. Analyses for both chromium as oxide, and for acetic acid, made it possible to determine the amounts of acid or of chromium hydroxide which were needed further, to bring the product into conformity with the correct formula for the neutral acetate.

As neutral salts, those were chosen which are usually to be met with in practical mordanting—sodium sulfate, chloride, nitrate, and acetate. Of these, various amounts ranging in general from ¼ mol. of neutral salt to one mol. of aluminium acetate, up to 2 mols. of neutral salt to one of the chromium acetate, were added to portions of the padding liquor.

The method of working was as follows:—from the same piece of cotton goods strips were cut, each about 80 cm. long and 15 cm. wide. Upon each of these strips three squares, 20 by 9 cm., were sharply marked out with lead pencil by means of a stencil, these designated areas being afterward cut out carefully for testing. Different whole strips were padded in each of sixteen baths (four neutral salts, four concentrations for each), under exactly the same conditions—temperature, time of working in bath, same roll-pressure. The strips were then dried at room-temperature, lying flat while drying, being frequently turned over and moved about to facilitate drying evenly, without concentration of the liquor in any one part by gravity, as far as possible. When dry, they were steamed at 0.25 at overpressure, washed at 80° C. in distilled water until the remainder of the unfixed mordant could no longer be detected in the wash-water, dried, and then the marked sections cut out for examination. These were left lying in the workroom for a few days, then put into vacuum desiccators; they were, however, weighed without special precautions against atmospheric moisture, since the slight variations noted from this cause were too small to affect the results. The determination of the amount of fixed mordant was carried out by ashing the samples, the weight of the ash, after deduction of the weight of the ash of the same area of untreated fabric, being taken as that of chromium oxide. The variation in the value was of course a criterion of the influence of this or that neutral salt in different quantity, present in the particular lot of liquor.

The second part of the paper (p. 88 et seq.) gives some details, and numerical values, as well as two graphs and three tables. A point was raised as to whether the total effect of steaming in the laboratory steamer was equivalent to that of the plant steamer, time for time. This point having been solved by experiments showing the effect of either type to be the same for a given time, the actual work was begun. The chromium acetate was used at a strength of 9.3° B., and the neutral salts in proper amount added in the dry form, to avoid altering the concentration. The goods were immersed in the bath for only a short time (3-5 seconds), and squeezed out to 80 per cent of the increase in weight. After drying, the samples were steamed in the laboratory steamer, in lots of eight, separated by strips of filter-paper. In order to determine the influence of the duration of the steaming, if any, two other lots were run through, one being subjected to steaming for one hour and fifteen minutes, the other for one and three-quarters hours. After washing and drying, the samples were analyzed.

It is evident, from the results, that (p. 113) the amount of mordant fixed increases with the duration of the steaming, that with short steaming (45 minutes) the influence of neutral salts upon the amount of mordant fixed is very great, a very small increase in the concentration of the neutral salt causing a serious diminution in the amount of mordant fixed; that, with longer steaming, the influence of neutral salts upon the amount of mordant fixed almost disappears; and that the retardation of the fixation of the mordant has a definite connection with the anion of the neutral salt present. The acetate has the most disturbing influence, the chloride less, the nitrate still less, and the sulfate least.

The work done upon aluminium acetate is more briefly reported. The general method followed was the same, though it was found that steaming beyond ½ hour was needless, the further changes observed being meaningless. One graph is given of the results, which are not by any means parallel with those obtained from chromium acetate; the presence of neutral salts strongly increases the extent of fixation of the mordant in this case, and in the following order: $NO_3 > SO_4 > Ac > Cl$.

The authors summarize their work as follows:—Apart from the quantitative relations, and in a purely qualitative aspect, of the influence of neutral salts upon the deposition of the mordant upon the fiber in the steamer, it has been proved that the presence of neutral salts in chromium mordants strongly depresses the amount of mordant fixed; while, on the other hand, the presence of these neutral salts in the aluminium mordant strongly increases the amount of mordant fixed.

That the influence of electrolytes upon the chromium mordant is contrary to that upon aluminium mordants, can be explained by the fact that chromium acetate is considerably less hydrolyzed in aqueous solution than is the case with aluminium acetate.

Under the influence of one agency or another (e.g., drying), aluminium acetate is in a position to dissociate hydrolytically, the hydrolysis taking place rapidly, so much so that a considerable part of the mordant precipitates in a form in which it cannot be absorbed properly by the fiber, and is removed from the goods by the subsequent washing. All factors, therefore, which delay the hydroly-

sis of the mordant, will in that case favor the fixing of the mordant upon the fiber.

As concerns the chromium mordant, it is evident that, in this case, the addition to the mordant of such salts as impede the hydrolysis of the mordant, not only favor the fixing of the mordant upon the fiber, but conversely impede it in a favorable manner, for the chromium acetate hydrolyzes very slowly by itself, and by itself is hardly hydrolyzed at all during the short duration of the steaming. The portion of the mordant not fixed by the fiber passes into the wash-water when the goods are washed after steaming, and so presents a source of loss from the cost side.

For practical application, it may be noted that (a) the presence of neutral salts in acetate mordants offers no advantage in comparison with salt-free mordants; in some cases (e.g., when steaming is brief) a high concentration of neutral salts in the mordant may be actually harmful, from the point of view of full utilization of the chromium mordant; (b) in case of printing upon the aluminium mordant, for example, in alizarine printing, addition of common salt, barium nitrate, calcium nitrate, etc., to the paste must increase the extent of fixation of the mordant, and, consequently, increase the depth of brilliancy of the dyeing.

ANNUAL MEETING AND CONVENTION A. A. T. C. C. Providence, R. I. December 4 and 5, 1936

BOOK REVIEW

Processing and Finishing Cottons. *By James F. Monaghan, Colonel Ordnance, U. S. Army, and Consulting Textile Finishing Engineer. First Edition, Two Volumes, 62 Chapters, 1,008 Pages, 129 Illustrations, 152 Finishing Formulae and Recipes. Published by Frank P. Bennett & Co., Boston, Mass.* 1935. *Price,* $12.00 *delivered.*

This book is the outcome of Col. Monaghan's many years of experience and study in the finishing plants of this country and abroad. He is to be commended for having undertaken the laborious and painstaking task of bringing together for study and reference a vast amount of material in regard to bleaching, dyeing, starching, drying, mercerizing, and finishing, which without question constitutes the most complete book upon the general processing of cotton textiles that has been published in the United States.

The principles involved in cotton finishing are discussed quite fully, the faults which most commonly occur are explained, and advice is given for the correction of many of the defects which are constantly confronting the cotton finisher.

The completeness of the work is impressive, and the reader will constantly find material not published in any other book. It can be highly recommended as a text-book for the student of cotton finishing and a reference book for the experienced cotton finisher.

The following condensed outline of its contents will immediately suggest its broad scope.

CONTENTS: Introduction, Significance and Scope of Finishing, Grey Goods, Construction and Faults, Injury to Cotton Fiber and Devil Marking, Materials to Be Processed, Components and Chemicals in Processing, Theory of Bleaching, Bleaching Methods, Purification of Linters, Nitration of Cellulose, Bleaching Machinery, Theory of Dyeing, Dyeing of Fabrics, Dyeing Machinery, Starching of Piece Goods, Water Mangling and Starching, Mercerization.

Drying and Drying Machinery, Methods and Machinery of Printing, Finishing Processes, Straightening of Filling, Lustering, Chasing, Hydraulic Mangling, Beetling, Damping, Conditioning, Schreiner Calender Operation, Embossing, Engraving, Tentering, Making of Sheets and Pillow Cases, Making-Up.

Processes for Finishing Sheeting, Linen Finishes, Shirtings, Towels, Damask, Shoe Goods, Bag Cloths, Batiste, Broadcloths, Cambrics, Coutils, Cretonnes, Crinolines, Chintz, Diapers, Drills, Ducks, Twills, Flannels, Interlinings, Jeans, Lawns, Nainsooks, Pillow Tubing, Poplins, Rep, Sateens, Sign Cloth, Voiles, Print Cloths, Spun Glass Finish, Book Cloths, Photo and Label Vellums, Tag Cloth, Vellums, Blue Print Cloths, Holland Shades, Oil Opaque Shades, Beetling of Shade Cloths, Painting.

Personnel in management, Labor Control, Banking and Expansion, Facilities for Plant Operation, Water Supply and Filtration, Power.

NEW PRODUCTS—TRADE NOTES

● PERKINS' ANNUAL OUTING

Mechanical experts and heads of various departments of B. F. Perkins & Son, Inc., and the affiliated American Tissue Mills gathered for an annual outing Saturday, August 29th. The outing was held on the spacious grounds owned by the company at Forge Pond, Granby, Mass. Owing to unfavorable weather, the Perkins Lodge and a large tent erected on the lawn were used for the festivities, which included an old fashioned baked chicken dinner.

A unique feature of the gathering was broadcasting from the dining tent through sound apparatus carried through the famous American Tissue Mills' circus truck. A high note of the after-dinner exercises was the general tone of the speeches which denoted a heavy demand for products of both companies.

● DUPONT RELEASES

New products recently announced by the Dyestuffs Division of E. I. du Pont de Nemours & Company include:

Du Pont Neutral Brown 2RS—a new

acid dye which produces bright, reddish brown shades on pure and tin-weighted silks. It is said to be a readily soluble, level dyeing color and to exhaust well so that it is suitable for application in various types of dyeing apparatus. It is particularly recommended by the manufacturers for use in shading the silk in cotton-silk hosiery as it is said to possess excellent affinity for silk in a neutral bath. Besides, it is described as exhibiting very good fastness to cross-dyeing with acetic acid, hot pressing, perspiration, salt water, water spotting and good fastness to light and washing. Du Pont Neutral Brown 2RS is further said to be well suited for discharge purposes, yielding pure whites with the use of both neutral and alkaline Sulfoxite C Pastes.

Du Pont Anthraquinone Blue SWF—a new acid color, an important addition to the line of dyes for wool, and when used as a straight shade it yields bright, medium shades of blue. It is said to possess generally good all-round working properties, and to be suitable for dyeing wool yarn and piece-goods of all types. This product is further said to be readily soluble, to exhaust well, and to possess the requisite fastness for a piece dye color. It is stated that it exhibits good fastness to light and very good resistance to both cold and salt water spotting, ammonia, soda ash, dry stoving, rubbing, hot pressing and steaming. Du Pont Anthraquinone Blue SWF is of especial value for mode shades. It should, therefore, be widely used for producing popular seasonal shades on ladies' dress-goods.

Diagen Black MR (Patented)—the latest addition to the Du Pont line of stabilized azoic colors which is particularly designed for printing on cotton. "Diagen" Black MR is said to be a homogeneous black, easy to apply, readily soluble, economical, and to possess generally good fastness and working properties. It is expected to be found of interest as a self-shade for producing full blacks and also as a shading color for both browns and dark blues.

"Luxol" Brilliant Green BL Supra (Patented)—a new addition to the line of spirit soluble colors and the brightest of the Luxol Green types. It is expected to be found an excellent spirit printing color as it is said to possess good solubility in alcohol and, in addition, to be fast to light and to exhibit good tinctorial strength.

Ponsol Flavone GCS Double (Patent Applied For) and *Ponsol Red BNS Double*—two new vat colors manufactured in grain form. They are said to be equal in strength and close in shade to the corresponding double paste brands and to possess identical fastness properties. The advantages of the grain types are manifold. It is claimed that these products are stable to storage so that there is little possibility of the formation of lumps even after a prolonged period. It is further stated that dusting is considerably minimized and because of their excellent state of dispersion and fineness, it is possible to obtain very satisfactory results in dyeing by the pigment pad and package machine methods.

"Diagen," "Sulfoxite," "Luxol," and "Ponsol" are registered trade-marks of E. I. du Pont de Nemours & Co., Inc.

● GENERAL RELEASES

General Dyestuff Corporation announces release of the following circulars and pattern card. Copies are available upon request.

Indanthren Dark Brown R T Paste—which is best dyed according to the IW method. It is said to produce comparatively inexpensive deep chocolate brown shades of a reddish cast which are of interest both for dyeing yarn and piece goods. It is claimed to possess very good fastness to light and washing and excellent fastness to chlorine. Circular G-151.

Indanthren Dyestuffs on Mercerized Cotton Yarn—a new pattern card illustrating the various Indanthren types dyed on mercerized cotton yarn in light, medium and heavy shades. Pattern card I.G.-1071.

Indanthren Navy Blue 3 G. Paste—a new vat dyestuff said to produce comparatively inexpensive Navy Blue shades of excellent fastness to light, very good fastness to washing and good fastness to chlorine. Circular G-152.

● CIBA TABLE

Ciba Company, Inc. has published a table for the conversion of decimal percentages into ounces and grains for the use of dyers. It is printed on heavy stock and is of a convenient size so that it may be tacked on the wall for quick reference. Copies are available upon request.

● ACTIVATED CARBON PATENTS

A decision rendered by the United States Circuit Court of Appeals for the Second Circuit August 10, 1936, affirmed the decree of the United States District Court for the District of Connecticut May 13, 1935, which held that certain claims of U. S. patents Nos. 1,497,543 and 1,497,544, covering activated vapor adsorbent carbon, were valid and infringed.

The suit was brought by National Carbon Company, Inc., unit of Union Carbide & Carbon Corporation, against Richards & Company, Inc., and The Zapon Company, of Stamford, Conn., because the two latter companies were using for solvent recovery activated coconut carbon which had been made by The Barnebey-Cheney Engineering Company, of Columbus, Ohio.

United States District Judge Hincks held that this constituted infringement of the plaintiff's patent claims which he found valid. He rendered judgment in favor of the plaintiff for $24,410.65 on account of the infringement.

In rendering the decision affirming the decree of the District Court, Circuit Judge Swan stressed the fact that the defendants were not charged with infringement of the patented process but with infringement of certain product claims by the use of infringing carbon in their business. This point was further emphasized in the decision as follows:

"It was proved that the defendants, with knowledge that they would be charged with infringement, purchased from The Barnebey-Cheney Engineering Company carbon that was known as '60 Minute Adsorbite.' Though in part heresay, this evidence was admitted prior to objection and no motion was made to strike it out. Dr. Ray testified that he had tested '60 Minute Adsorbite' of the Barnebey Company and found it to infringe the claims in suit. Furthermore, Dr. Ray gave his opinion as an expert, based on Mr. Creighton's description of the defendants' cycles of operation and efficiency of recovery, that any carbon so operating infringed the claims. His testimony was not even subjected to cross-examination. On this record the plaintiff made out a *prima facie* case of infringement."

The National Carbon Co. began the manufacture of activated carbons in 1919 by the Chaney process. The Chaney patents were based on the wartime discoveries of Dr. N. K. Chaney and his associates in the National Carbon Co.—discoveries that assured an ample supply of highly efficient gas mask carbon at a time when the need was most urgent. After the war, it was found that this highly activated carbon was equally efficient for a variety of peacetime uses. Marketing of these products is handled by Carbide and Carbon Chemicals Corp. which is also a unit of the Union Carbide and Carbon Corp. Activated carbon has found considerable use in the recovery of solvents from air mixtures in the manufacture of rayon, artificial leather, coated fabrics, coated paper, transparent wrapping materials as well as uses in other industries.

● LIQUID CHLORINE

The Columbia Alkali Corporation announces that liquid chlorine and electrolytic caustic soda have been added to their list of products. A complete new plant, modern in every respect, has already been finished and shipments are now being made in single and multiple tank cars as well as in 100 and 150 lb. cylinders. The new plant is located at Barberton, Ohio, and it is stated that every benefit of scientific development and every manufacturing refinement have been employed in connection with the operation of this plant. Years of careful preparation, the enlistment of foremost specialists and extensive research

are said to stand behind the plant. Precautions have been taken to protect the operators in the plant and users of the product from hazard. Care has also been taken to prevent variation which, it is stated, has been reduced to minimum.

A standard type electrolytic cell is used in the new plant. Raw materials in abundance, a favorable power situation, efficient plant operation and excellent transportation facilities are said to insure users of Columbia chlorine a most economical and dependable source of supply. Containers are of the latest improved design.

Liquid chlorine is used in a wide variety of industries including water purification and sewerage disposal, bleaching of pulp, paper and textiles and as a raw material in the production of many industrial chemicals. Provision has been made for expanding production facilities by units at this plant.

For nearly half a century Columbia Alkali Corporation has been an important producer of soda ash, caustic soda and by-products. Executive offices are located at 30 Rockefeller Plaza, New York City and branch sales offices are maintained at Chicago, Pittsburgh, Cincinnati and at the plant in Barberton. It is a wholly owned subsidiary of Pittsburgh Plate Glass Company.

● TEXTILE ORGANIZATION STUDY

The Wharton School of the University of Pennsylvania has been appointed as the research agency to conduct the study of "Production and Distribution Organization in the Textile Industry," the financing of which was recently authorized by The Textile Foundation. The investigation will be carried on under the advisory supervision of the Committee on Economic Research of the U. S. Institute for Textile Research and an auxiliary committee composed of presidents of several of the major textile associations.

The Industrial Research Department of the Wharton School has had close contacts with the textile industry for a long period of years, through its work in the wool and hosiery divisions particularly—and more recently in connection with the program of textile education. Joseph H. Willits, Dean of the Wharton School, will be in general charge of the study and will be assisted by the following members of the Industrial Research Department: C. Camby Balderston, professor of industrial management; Anne Bezanson, co-director of the department; H. S. Davis, in charge of the wool section; and George W. Taylor, in charge of the hosiery section. Mr. Davis will serve as secretary of the group. Other members of the department and of the school will be called upon to participate in particular phases of the study.

As announced at the time the authorization of this study was made known by The Textile Foundation, it will involve particularly investigation into the factors affecting the success or failure of various types of organizations which have undertaken, at any important point to bridge the gap between mill and consumer. Its purpose is to serve as a guide to individual manufacturers in their own determination of future policies. Factors influencing periodical variation in production will also be given consideration as part of this study.

The members of the Committee on Economic Research which recommended the study and will act as the sponsoring committee include: Fessenden S. Blanchard, Pacific Mills, chairman; Paul T. Cherington of Cherington, Rope & Wood; Stanley B. Hunt, Textile Economics Bureau; H. V. R. Scheel, textile consultant; W. Homer Turner, Marshall Field & Co.; Douglas G. Woolf, editor of Textile World; A. W. Zelomek, International Statistical Bureau.

The advisory group representing textile associations, who have joined with the above committee in recommending the study and in approving of the appointment of the Wharton School to conduct it, includes W. Ray Bell, President, Association of Cotton Textile Merchants of New York; Arthur Besse, President, National Association of Wool Manufacturers; A. W. McCready, representing National Federation of Textiles, Inc.; Dr. C. T. Murchison, President, Cotton-Textile Institute.

Other executives of leading textile associations who have expressed interest in this study and a willingness to cooperate are: A. F. Allison, secretary of the International Association of Garment Manufacturers; Roy A. Cheney, Managing Director of the Underwear Institute; Earl Constantine, Managing Director of the National Association of Hosiery Manufacturers; Charles Whitney Dall, president of the National Rayon Weavers Association; and W. P. Fickett, president of the Textile Fabrics Association.

The Textile Foundation is organized for scientific and economic research for the benefit and development of the textile industry, its allied branches, and including that of production of raw materials.

Directors are: Franklin W. Hobbs, chairman; Stuart W. Cramer, treasurer; Frank D. Cheney, Daniel C. Roper, and Henry A. Wallace.

● SOAP SPECIFICATIONS

According to *Industrial Standardization*, publication of the American Standards Association, a critical review of existing specification requirements for soap will be the first undertaking of the specifications subcommittee of the newly organized American Society for Testing Materials' Committee on Soap and Detergents. The subcommittee will start preparing new specifications, after it has completed its preliminary study.

Other subcommittees working under this new committee on Soap are those on Methods of Analysis and on Nomenclature.

Soaps and detergents, including the materials entering into their manufacture, will be the scope of the general committee.

H. P. Trevithick, Chief Chemist, New York Produce Exchange, is chairman of the committee; F. W. Smither, National Bureau of Standards, is vice-chairman; and B. S. Van Zile, Colgate-Palmolive-Peet Company, is secretary.

The subcommittee on methods of analysis will include a number of members of the soap committee of the American Oil Chemists Society and is expected to review the methods of analysis developed by the A.O.C.S. committee with a view to recommending their adoption by the Society.

The work on nomenclature will probably start with a consideration of definitions of different types of detergents.

● EXHIBITION

An exhibition of Hosiery and knitting machinery, yarns and fabrics will be held at the Granby Halls, Leicester, England on October 7th through the 17th. It is sponsored by the Textile Recorder Machinery and Accessories Exhibitions Ltd. It is stated that the exhibits will justify visits from any part of the world. They will be numerous and will comprise many important new machines and accessories.

● EXPECTS RECORD ENROLLMENT

Dr. Thomas Nelson, Dean of the Textile School, North Carolina State College, stated recently that the prospects for Fall registration were very encouraging and that he expected the Textile School enrollment for the coming year would exceed the record of last year when the Textile School of State College enrolled more day students than any other textile school in America.

He said that applications for admission had been received from Canada to Mexico. Many of those applying for admission have had previous college work and now want to enter the Textile School and prepare themselves for service in the textile industry.

● JOINS A. D. LITTLE, INC.

Horace N. Lee whose twenty years of diversified experience in the microscopy of textile and other fibers has equipped him to deal effectively with the problems of textile manufacture is now a member of the staff of Arthur D. Little, Inc., Cambridge. His graduate work at Harvard University in biology in which he specialized in the microscopical study of plants and plant fibers, followed by his work at the Forest Products Laboratories of Canada in microscopical work and photomicrography, furnish the basis for

his work in the microscopical investigations of textiles at the Warwick Mills of the Wellington Pierce Company, Centerville, R. I. During his stay there he was associated with F. J. Hoxie, a pioneer in the application of microscopy and photomicrography to the study of textile problems. Since that time Mr. Lee has developed a number of new and efficient methods for fiber study and fiber identification and has included a special three year investigation of fibers as a member of the Harvard University Staff under a research appointment in which he has been associated with Professor Oakes Ames.

• CHEMISTRY DELEGATE

Gustavus J. Esselen sailed on the S. S. Queen Mary August 12, 1936, to represent the National Research Council and the National Academy of Science as an official delegate at the XIIth Conference of the International Union of Chemistry in Lucerne, Switzerland, August 16th to August 22nd. Dr. Esselen was recently elected a member of the National Research Council. He is a member of the Board of Directors of the American Chemical Society, a director of the American Institute of Chemical Engineers, and president of Gustavus J. Esselen, Inc., chemical consulting firm of Boston.

• CHINESE DYE MARKET

The Chinese demand for dyestuffs continues poor due to uncertainty regarding smuggling and the unsettled political situation, according to reports from the American Trade Commissioner at Shanghai, made public by the Commerce Department's Chemical Division.

Chinese importers estimate that business during the first five months of the current year was approximately 10 per cent below that of the corresponding period of 1935, and that the turnover during the 1935 period was well below normal. Dealers in imported dyes are showing little interest in placing future orders and consumers are restricting purchases to immediate requirements, the report states. No increase in consumer demand is anticipated until the political and smuggling situation improve, it was stated.

Although business is far from satisfactory and the outlook is uncertain some importers feel that deferred orders are accumulating and that much of the present loss of business will be made up later when conditions become more settled.

Interest in quality dyes has recently developed in China, and while no substantial orders have been placed as yet, samples and demonstrations have been requested. Chinese manufacturers are also showing interest in woolens, due in part to the gradual shift from Chinese to foreign style clothes, and if such mills should materialize, additional dyestuffs would be required, according to the Commerce Department.

China is the leading foreign market for American dye products, normally taking from 25 to 30 per cent of the total amount exported from the United States, it was stated.

• BELGIAN WORKERS' AGREEMENT

Largely through efforts of the Belgian Ministry of Labor an agreement has been reached between workers and employers in the chemical industry which has freed that important branch of Belgian economy from the full force of strikes which still continue in other local industries, according to reports from the office of the American Commercial Attache, made public by the Commerce Department's Chemical Division.

The agreement, among other things, provides for a minimum pay scale, a forty-hour week, six day vacations with pay each year, and the establishment of mixed commissions of employers and workers to arbitrate disputes, the report states.

The practical effects of these resolutions will be to increase most wages from 5 to 15 per cent throughout the chemical industry and the forty-hour week will necessitate the institution of four shifts daily in those plants which operate continuously, it was stated.

The chemical branch is ninth in importance among the industries of Belgium and provides employment for 5 per cent of the country's industrial workers. According to the 1930 census approximately 80,000 workers were employed in the industry and persons engaged in selling chemical products numbered 22,620, or about the same as was engaged in the distribution of agricultural products, according to the Commerce Department.

In foreign trade Belgium ranks fifth as a chemical leader, being exceeded only by France, the United Kingdom, the United States and Germany.

CLASSIFIED

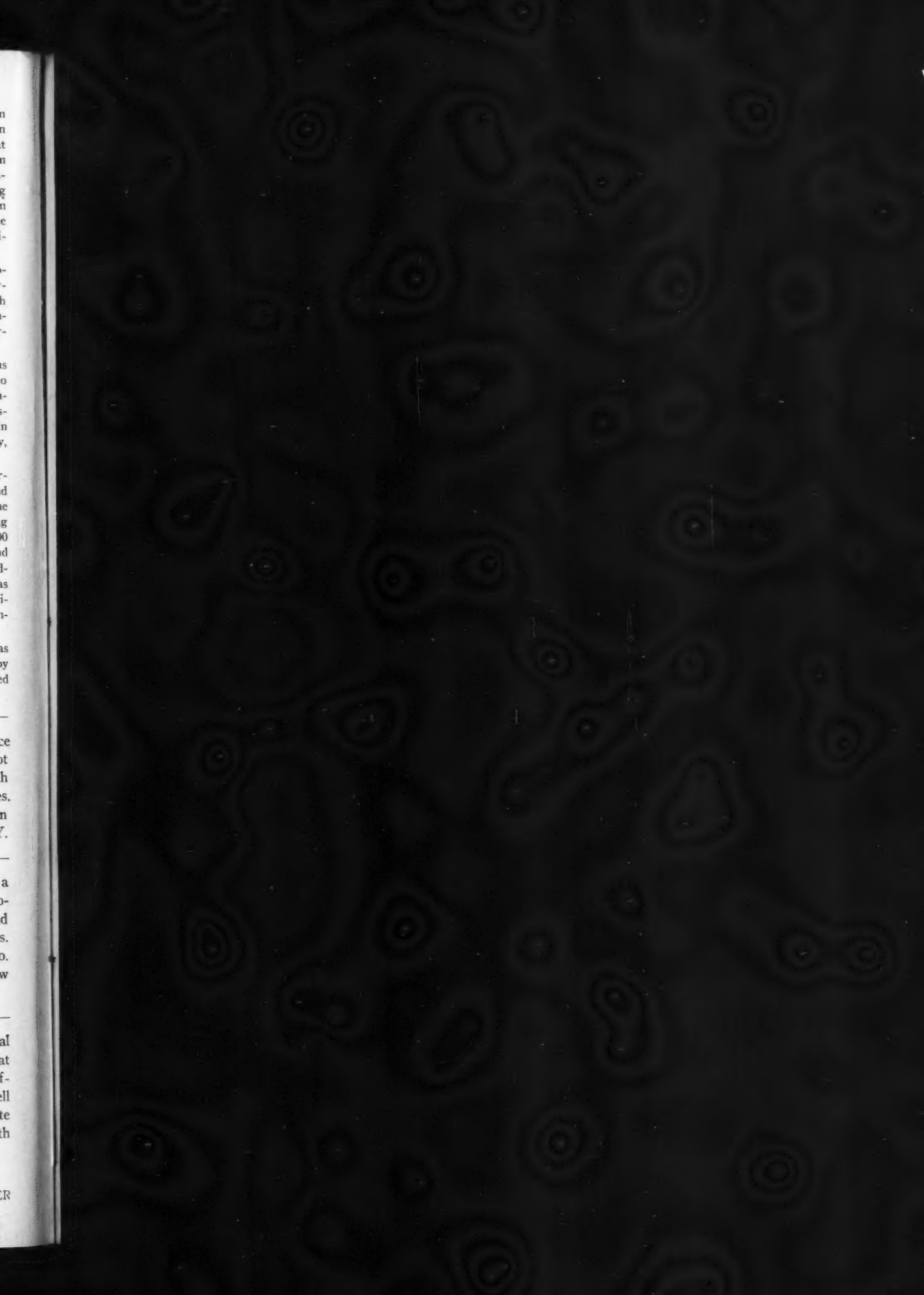
The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

WANTED—By old established firm in New England, handling cotton and rayon piece goods, thoroughly competent and experienced dyer. Address reply to Box No. 919, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: DYESTUFF SALESMAN — Position open to cover New York State for established concern. Furnish complete details—confidential. Write Box No. 920, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

OPPORTUNITY WANTED — Graduate, Textile Chemistry and Dyeing Course, Lowell Textile Institute, desires connection, preferably in sales department. Five years' experience in sales of textile chemicals. Has thorough knowledge of dyeing, printing and finishing. Age 28, married. Write Box No. 921, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: DYER—18 years' experience on all kinds of hosiery, wants to change. Will accept reasonable salary. Age 40, married. Nine years with present employer. Will go anywhere. Good references. Member A.A.T.C.C. Write Box No. 922, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED—Leading Textile Chemical House wants a high type salesman with following in New England. Applicants should have thorough technical education and experience. We expect to pay a fair salary and expenses. Submit photographs with application. Write Box No. 923, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED—Textile analyst and practical dyer on cotton and woolen goods recently employed at Amoskeag wants position in laboratory or dyehouse preferably in the New England States. Lowell and Cornell education. Unusual references gladly furnished. Write Box No. 924, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.